EG - ARS - 73
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« SURVEY OF ORGANISMS ASSOCIATED WITH AQUATIC WEEDS AND INTRODUCTION AND EVALUATION OF NEOCHETINA EICHHORNIAE AND N. BRUCHI FOR BIOLOGICAL CONTROL OF WATERHYACINTH IN EGYPT »

FINAL REPORT

(July 1, 1978 — December 31, 1983)

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3) PROJECT TITLE	:	"Survey of organisms associated with aquatic weeds and introduction and evaluation of *Neochetina eichhorniae* and *N.bruchi* for biological control of waterhyacinth in Egypt".
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Our deep express is due to Dr. Ted D. Center Co-operating scientists of the project Aquatic Plant Management Lab. Fort Lauderdale Florida, for all his help and assistance in reviewing and following the project. The principal investigator wish to thank all scientists in U.S.D.A. for the help and time given during his visit to U.S.A.

We are deeply appreciate the efforts of the insect identification division in Smithsonian Institute for help in identification of the collected species.

SUMMARY

Waterhyacinth *Eichhornia crassipes* (Mart) Solms., (Fam. Pontedriaceae) is one of the most serious aquatic floating weeds in the world. The weed has been seen in Egypt for the first time during the years 1926-1931. In 1965, waterhyacinth started to be a serious common problem in Egypt since most of the irrigation and drainage canals in the governorates of Miditerranean cost, Lower Egypt (Delta) and Middle Egypt have been heavely infested. The control of this weed in Egypt is still based on the mechanical and chemical methods. In order to determine the possibility of using insects for biological control of this weed in Egypt, two promising weevils, *Neochetina eichhorniae* Warner, and *N.bruchi* Hustache (Coleoptera, Curculionidae) are devoted to be introduced to Egypt for this study.

Accordingly, a PL 480 project entitled "Survey of organisms associated with aquatic weeds and introduction and evaluation of *Neochetina eichhorniae* and *N.bruchi* for biological control of waterhyacinth in Egypt" was negotiated and approved to be conducted between USDA and the Egyptian Ministry of Agriculture. The project has been started July 8, 1978 and it was planed to continue untill June 30, 1983.

The main points considered for the study were :

1- Determination of the present status of waterhyacinth infestation allover the country.

2- Determination of biological control agents might be occurred in Egypt for control of waterhyacinth.

3- Introduction of certain insects previously tested in some other countries and proved to be safe and specific to feed only waterhyacinth.

4- Releasing of the tested insects in semi-natural site for production and evaluation.

5- Survey of the Eursian Water-Milfoil (Myriophyllum spicatum L. in Egypt.

A taxonomic and original of waterhyacinth with historical view was given in this report.

During the project period survey of waterhyacinth and the associated organisms were conducted including measurments of waterhyacinth plants in nature from different localities for evaluation of the weevils after the release. Data obtained indicated that waterhyacinth is widely distributed in almost all governorates of lower Egypt and Mediterranean Coast, while in upper Egypt it proved to occur only from Cairo to Minya governorates and not in the most southern governorates of Assuit, Sohag, Quena, Asswan and Nasser's lake. No organisms proved to be of importance as biological control agent

of waterhyacinth. It has to be mentioned that sever damage were found during the survey caused by the lepidopterous moth Spodoptera littoralis (Bois.) in Fayouim governorate. Unfortunately this insect is known in Egypt as cotton key pest. The aphid (mostly Pentalonia nigronervosa (Coq.) was also found to cause heavey infestation to waterhyacinth. From measuring of 450 hole waterhyacinth plants it was found that the root length ranged between 14.69 cm and 25.62 cm and the average number of leaves per plant ranged between 4.1 and 8.75 leaves, while the petiole length measured an average ranged between 11.3 cm and 50.7 cm. The total leaf blade area averaged between 29.26 cm^2 and 165.18 cm^2.

Review concerning the arthropods which associated with waterhyacinth in the world was also given with the biological, host specificity, and taxonomic studies of these weevils.

Several laboratory tests were conducted under quarantine conditions with notes on the life cycle and biology of N.eichhorniae and N.bruchi which indicated that eggs of Neochetina were inserted individually or in groups of 2-5 whitish yellow eggs of about 0.79 mm long in the feeding scars and petiole. The incubation period is about 6-10 days on an average temperature of 23.4°C and R.H. 71%. Neochetina spp. have 3 instar larvae complete their developing within

about 22 days.

1- Survey for waterhyacinth in a following period indicated that : waterhyacinth were widely distributed in all governorates of Delta and Middle Egypt and absolutely not in the most southern governorates of Assuit, Sohag, Quena, Asswan and Nasser's Lake. In Damanhour, Behiera governorate the average number of plants per m^2 was 172.6. The maximum numbers occured during the growing season from March to June. The average root length of about 280 plants ranged between 10 cm and 28.4 cm. The number of leaves per plant ranged between an average of 3.4 and 8.0 leaves. The petiole length measured an average ranged between a minimum of 7.2 cm and a maximum of 35.7 cm. The total blade leaf area measured an average ranged between a minimum of 25.5 cm^2 and a maximum of 143.2 cm^2.

In Mariot lake the number of plants per m^2 ranged between a minimum of 52 plants and a maximum of 176 plants with an average of 101.9 plants/m^2. The plant measurments of about 260 plants were, root: minimum of 1.5 cm and maximum of 31.5 cm with an average ranged between 5.7 cm and 14.6 cm. Petiole length : 2 cm and maximum of 83 cm with an average ranged between 7.4 cm and 59.0 cm. Leaf blade area: minimum of 2.5 cm^2 and maximum of 330 cm^2 with an average ranged between 33.1 and 215.4 cm^2, number of leaves per plant: minimum of 2 and maximum of 12 with an average ranged

between 4.0 and 8.7 leaves per plant.

In Fayoum governorate the number of plants/m^2 ranged between a minimum of 60 and a maximum of 180 with an average of 114.6 plants per m^2. The measurments of about 200 plants examined were: Roots ranged between an average of 7.6 cm and 35.5 cm, average number of leaves per plant ranged between 4.2 and 8.2, the average length of petiole ranged between 10 cm and 54.3 cm, the average leaf blade area ranged between 35.9 cm^2 and 145.1 cm^2.

2- Two species of aphids, *Aphis fabae* and *Pentalonia nigronervosa* were found infesting waterhyacinth. Severe damage caused by the cotton leaf-worm *Spodoptera littoralis* - which are known in Egypt as cotton key pest - was observed on the weed.

The survey indicated that, there is no specific organisms associated with waterhyacinth in Egypt. Seasonal rate of growth of waterhyacinth per m^2 in three localities, Beheira, Alexandria and Fayoum governorates has been determined.

Two shipments of the adult weevils of *Neochetina* spp. have been recieved in September 1979 and July 1980.

In order to determine the host specificity and safety of *Neochetina* spp. for introduction and releasing in Egypt,

series of feeding tests were conducted. Group plants test, paired plant tests and starvation tests have been indicated the specificity of both N.eichhorniae and N.bruchi to water-hyacinth only and not to any other of plants tested.

During the project period several surveying trips were conducted to different parts of the country to determine the occurrence of Myriophyllum in Egypt. Results obtained from examining of 147 sites indicated the absence of the weed in the serveyed governorates. The main species of submerged weeds collected were :-

1- Potamogeton crispus L.

2- P.pectinatus L.

3- Najas armata Lindb.

4- Ceratophyllum demersum L.

In July 1980, 65 and 50 adults of N.eichhorniae were released in Embaba, near Cairo and Mariout Lake Alexandria respectively. Feeding spots have been observed starting March 1981 in the first site. The second releasing site was chemically treated officially.

Host specificity tests were completed. Plants tested were : banane, lettuce, indian shot, onion, spinach, sugar beet, vegetable beet, wheat, and waterhyacinth. Four series of host specificity tests were conducted. These are: group plants

tests, paired plants tests, starvation tests and larval tests. Results obtained concluded that the genus Neochetina is closely tied only to plants of the family Pontedriaceae in which waterhyacinth is the only species known to be occured in Egypt. The fact that the life cycle of the weevils could be completed only by pupation in cocoons under water provids the safty of N.eichhorniae and N.bruchi to be introduced and released in Egypt.

Two consignments of Neochetina and one of Sameodes have been received in August 1980.

25 adults of N.eichhorniae out of 310 adults brought back from Brisbane, Australia have been released in the Parasite Laboratory at Giza. Weevils have been established and 4 generations were obtained.

The principal investigator attended the "V International Symposium on the Biological Control of Weeds" in Brisbane, Australia. Following the Symposium, the principal investigator spent about one week in Long Pocket Laboratories and a total of 310 adults of N.eichhorniae were collected and hand carried to Egypt.

During the fourth year of the project, certain plants were suggested by the Egyptian Ministry of Agriculture to be included in the host specificity tests of Neochetina spp.

The plants were chosen based on their aquatic habitat and their historical importance as ancient Egyptian plants. These plants were: Cyperus papyrus; Fam. Cyperaceae; Nymphaea coerulea and N.lotus var. aegyptia; Fam. Nymphaeaceae; and Cyperus alopecroides Fam. Cyperaceae. Group plants test, paired plants test and starvation test were conducted. Results obtained from these study indicated that, there would be negligible or no damage outside the family Pontederiaceae which is to the best of our knowledge, represented in Egypt by waterhyacinth; Eichhornia crassipess only.

Neochetina spp. received were released in an artificial lake in Al-Orman Garden, Giza, Giza governorate. Primary examinations indicated the establishment of both insects in nature. Insects have been released in May, 13, 1982 on 10 plants only. By August 1982, several plants were observed in the lake with many feeding spots.

Several surveying trips were conducted to different sites in Egypt to determine the occurrence of the weed Myriophyllum spicatum in the country. Twenty-three collecting trips conducted during the fourth year of the project indicated the absence of Myriophyllum from all the examined areas.

Preliminary studies were donducted on the host specificity of the pyralid moth Sameodes albiguttalis under

quarantine conditions. Twelve plants including waterhyacinth were tested. Three experiments were conducted with the deposited eggs, first instar larvae and fourth instar. Results obtained indicated that Sameodes albiguttalis was very specific to feed and develop only on the target weed; waterhyacinth and not on any of the other plants tested.

Occasional survey on waterhyacinth was conducted throughout 58 field trips. It was observed from the survey that, waterhyacinth infestation seemed to be expanding south of Minya.

During the period 13-20 April, 1982. Dr.J.K.Balciunas conducted an official visit to Egypt for reviewing the project activities.

In July 1983, six months extention has been approved to complete the studies of the project.

Two main points were considered for studying :-

1- Survey of waterhyacinth in the most southern governorates of Egypt.

2- Evaluation of the released weevils in an artificial lake in Al-Orman garden.

It was reported before that waterhyacinth had never

been recorded in the most southern governorates of Assuit, Sohag, Quena and Aswan. Recently, several surveying trips to these governorates indicated the occurrence of the weed. Waterhyacinth infestations recorded in the most southern governorates of the country were scattered in small patches and not intensively distributed. The number of plants recorded per meter^2 averaged between 18-40 plants. During the last period of the project waterhyacinth plants found in upper Egypt were measured. Roots and petiols lengths; leaf area of 255 whole plants were measured and tabeled. Associated organisms were recorded. Results obtained indicated that there are no specific organisms occurred on waterhyacinth plants recently infested the most southern governorates of Egypt. In most cases, these organisms are known as common pests of different plants and crops in Egypt and some other countries.

Results obtained from studies conducted during the period of the project indicated the safety of both _Neochetina eichhorniae_ and _N.bruchi_ for release in nature for control of waterhyacinth. Accordingly, an official approval were obtained and 10 adults of _N.bruchi_ and 15 of _N.eichhorniae_ were released in an artificial lake of about 130 m^2 in Al-Orman Garden.

The releasing site was examined almost every two weeks.

The maximum number of adults of N.eichhorniae found per 25 plants was 9 adults during June 1983, while a maximum of 8 adults of N.bruchi was counted during October 1982. A maximum of three adults per plant were counted. Two months after weevils released, the total number of feeding spots counted were 225 feeding spots per 25 plants caused by 25 released adults of both species. The maximum number of feeding spots were 2532 per 25 plants during June 1983. This number of spots represents a total area of about 20.2 m^2 of leaves exposed surface.

In general conclusion, the studies conducted during the project period indicated that the main role of these weevils appear from their behaviour as leaf feeders which reduces the amount of water loose through evapo-transpiration from waterhyacinth broad leaves. The released insects are well established and spread everywhere on waterhyacinth in the lake.

DETAILED REPORT

INTRODUCTION :

Waterhyacinth Eichhornia crassipes (Mart) Solms., (Family Pontederiaceae) is one of the most serious floating weeds in the world. It causes a serious problem in many countries through blokage of water where irrigation and drainage are of economic importance, through blockoge of water transportation, fishing, water pollution and evapotranspiration.

Since it is very expensive and needs several treatments to use chemical control method beside the bad side effect of chemicals on water, fish, plants and humanity; study on the biological control agents of waterhyacinth that are safe and effective is urgently needed. Two promising weevils, Neochetina eichhorniae Warner, and N.bruchi Hustache (Coleoptera, Curculionidae) are devoted to be introduced to Egypt for control of waterhyacinth. Biological studies, and host specificity tests of these two insects were also needed to complete studies conducted in several other countries before releasing these weevils in Egypt and possibly many other countries.

The tropical family Pontedriaceae containes twenty one species distributed in six genera, all of them are

aquatic in habitat (Bennett 1967). Five species only of the genus Eichhornia are known and all of these species are native to South America and the West Indies (Castellanos 1958). The weed has been seen in Egypt for the first time during the years 1926-1931 (Simpson 1932). He recorded the occurrence of waterhyacinth near Cairo, Alexandria, Damanhour and Demiat, and it causes a serious problem in Manzala lake and Baher El-Baker derainages. In 1965, waterhyacinth started to be a serious common problem in Egypt since most of irrigation and drainage canals in the governorates of Miditerranean coast, Lower Egypt (Delta) and Middle Egypt have been heavely infested.

In July 1978, a 5 years PL 480 project entitled "Survey of organisms associated with aquatic weeds and introduction and evaluation of Neochetina eichhorniae and N.bruchi for biological control of waterhyacinth in Egypt" has been started between U.S.D.A. and the Egyptian Ministry of Agriculture.

Comments of the cooperating scientist indicated the request of conducting survey on a new aquatic weed the Eurasia Water-Milfoil (Myriophyllum spicatum L.) and associated organisms in Egypt. This work had been considered to be a part in the study.

The main targets for the project study were the determination of the present situation of waterhyacinth infestation

allover the country and searching for biological control agents which may be occurred in Egypt, for the control of this weed.

The main points suggested to be studied during the period of the project are :-

1- Survey of waterhyacinth, geogrophical distribution and seasonal history in Egypt.

2- Survey of different organisms associated with waterhyacinth and searching for specific species to be studied as biological control agents of the weed in Egypt. This may help-in part-for controlling waterhyacinth in Egypt and possibly some other countries.

3- Biological studies on the promising insects (if found) for biological control of waterhyacinth.

4- Introduction of the two curculionid weevils, _Neochetina eichhorniae_ and _N. bruchi_ to Egypt to be studied under quarantine conditions as promising insects for biological control of waterhyacinth. Later during the study, it is suggested that it will be of great importance of the project to introduce the pyralid moth _Sameodes albigutta-lis_ to be added to the study. Host specificity tests of these insects may determine their field release.

5- Highly significant specification of the tested insects on waterhyacinth will devote releasing of the tested insects in the infested areas for biological control.

6- Following the release of the insects, evaluation of them as biological control agents will be studied. It needs at least five years evaluation studies before a final decision could be made.

7- In personal discussion with the cooperating scientist, survey of the Eurasion Water-Milfoil (Myriophyllum spicatum L.) has been included as a part in the project activities.

8- Visit to Dr. J.K.Balcinuas to Egypt during the period 13-20, 1982 to review the project.

In July 28, 1983 a 6 months extention without additional funds has been approved between the Egyptian Ministry of Agriculture and U.S.D.A. to complete the studies going up under the project.

Two main points were considered to be studied. These are :-

1- Conducting several surveying trips to the most southern governorates of Egypt to determine the expandation of waterhyacinth in upper Egypt.

2- Conducting evaluation studies on the released weevils in Al-Orman garden, Giza.

On August 13, 1983 we have sent to Dr. T. Center the co-operating scientist of the project exeplanations for his comments concerning the 8th annual report. Three main questions were included concerning the release of *Neochetina* in the field, shipments of *Sameodes* recieved in Egypt, and establishment of *Neochetina* in nature. These could be explained that we are considering the May 1982 release in Al-Orman garden as our first successful release since all previous release were eliminated by herbicidal control.

It was reported in the 6th annual report that *Sameodes albiguttalis* tested under quarantine conditions were collected and recieved from Fort Lauderdale Florida and hand carried on April 24, 1981 by our colleogues from the Foreign Relation Department, who they were in official visit to USDA. It was also previously indicated in this report that the problem of field release has been solved and the weevils of both *Neochetina eichhorniae* and *N. bruchi* have been established.

WATERHYACINTH

Classification and Origin of waterhyacinth *Eichhornia crassipes* (Mart.) Solms.- Laub.:-

The genus *Eichhornia* belongs to family Pontedriaceae (Monocotyledones). Bennett (1967) mentioned that this tropical family, contains twenty-one species distributed in six genera, all of them are aquatic in habitat. Castellanos (1958) mentioned that the five known species of *Eichhornia* are all native to South America and the west Indies. He added that *E.crassipes* is now widespread in the tropical and to a lesser extent the sub-tropical regions of North and South America. *E.crassipes* (Fig. 1&2) varies from few cm to 1.25 meter long with the roots from 15 to 60 cm. It grows in fresh water but it can survive in salty water up to 14%.

Historical view :

Waterhyacinth was described for the first time by Karl. F.P. Martius (1824)*. He mentioned that this weed is originated in South America and it is concentrated in North Brazilia and Venziwela. In 1894 during the International cotton fair in New Orleans, the Japanees people distributed waterhyacinth as gifts to the visitors for it's beautiful

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* Nova Genera et Species; Hedesson Institute, New York.

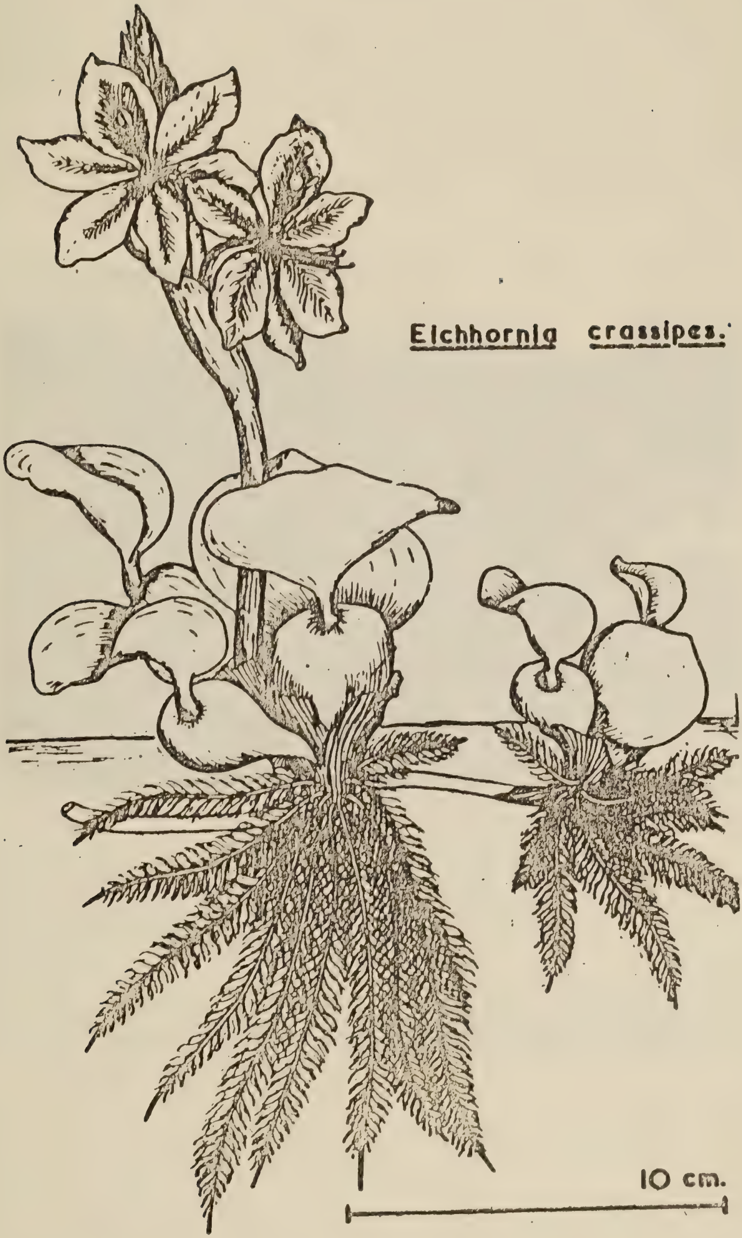


Fig. 1: Plants of waterhyacinth

Fig. 2 Waterhyacinth; Eichhornia crassipes (Mart.) Solms In Nature.

Fig. 2 Waterhyacinth (*Eichhornia crassipes*) (Mart.) Solms
In Nature

flower and since that date it started to be a problem in several places in U.S.A.

In Egypt, Simpson (1932) reported his remarks during the years (1926-1931) about the occurrence of waterhyacinth in the country. He mentioned that the weed has been seen near Cairo, Alexandria, Damanhour (Behiera governorate) and Demiat. He added that it causes a serious problem in Manzala lake and Baher El-Baker drainages. In 1965, waterhhyacinth started to be a serious common problem in Egypt since it has been covered most of the irrigation and drainage canals in the governorates of Mediterranean coast, Delta and middle Egypt.

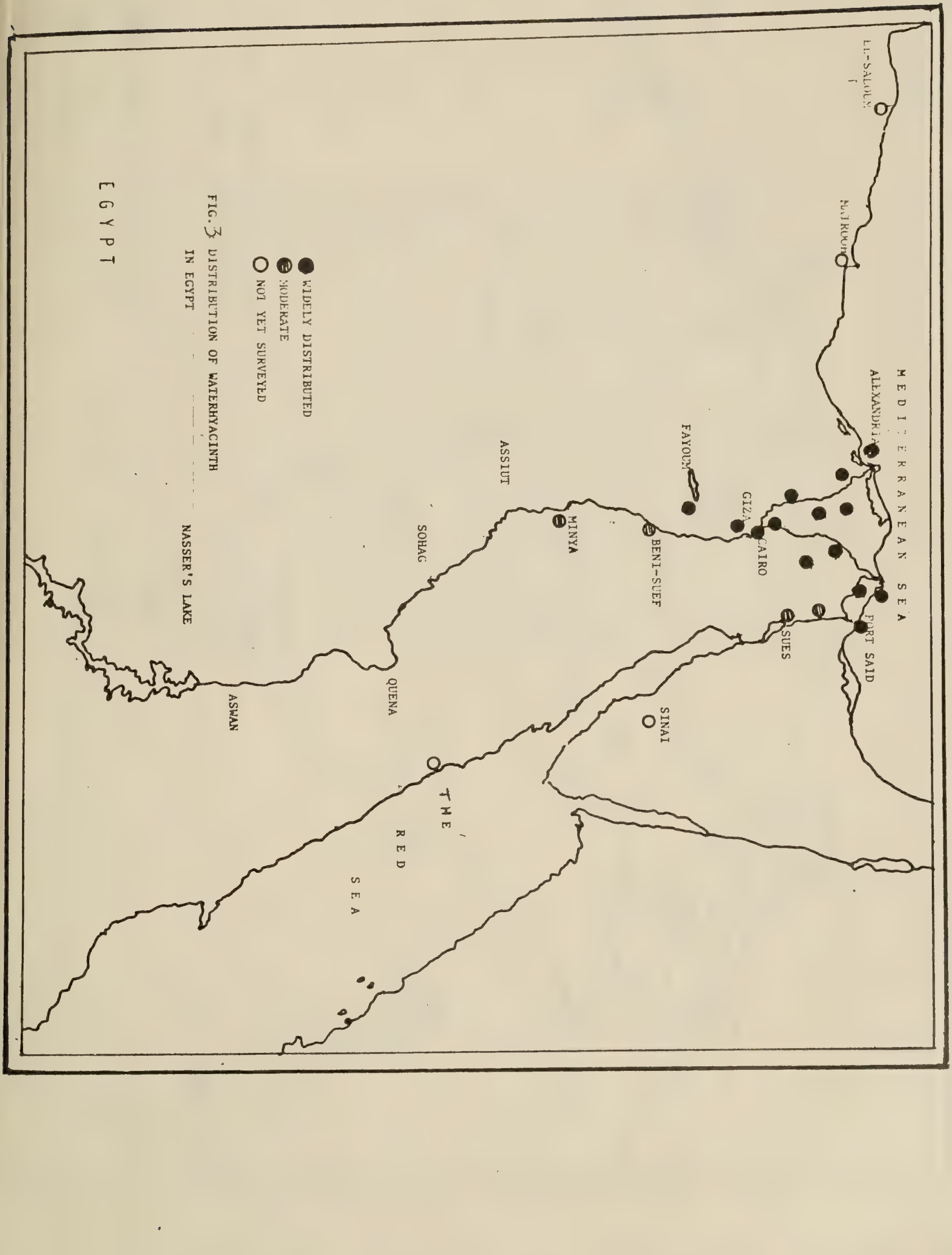


FIG. 3 DISTRIBUTION OF WATERHYACINTH IN EGYPT

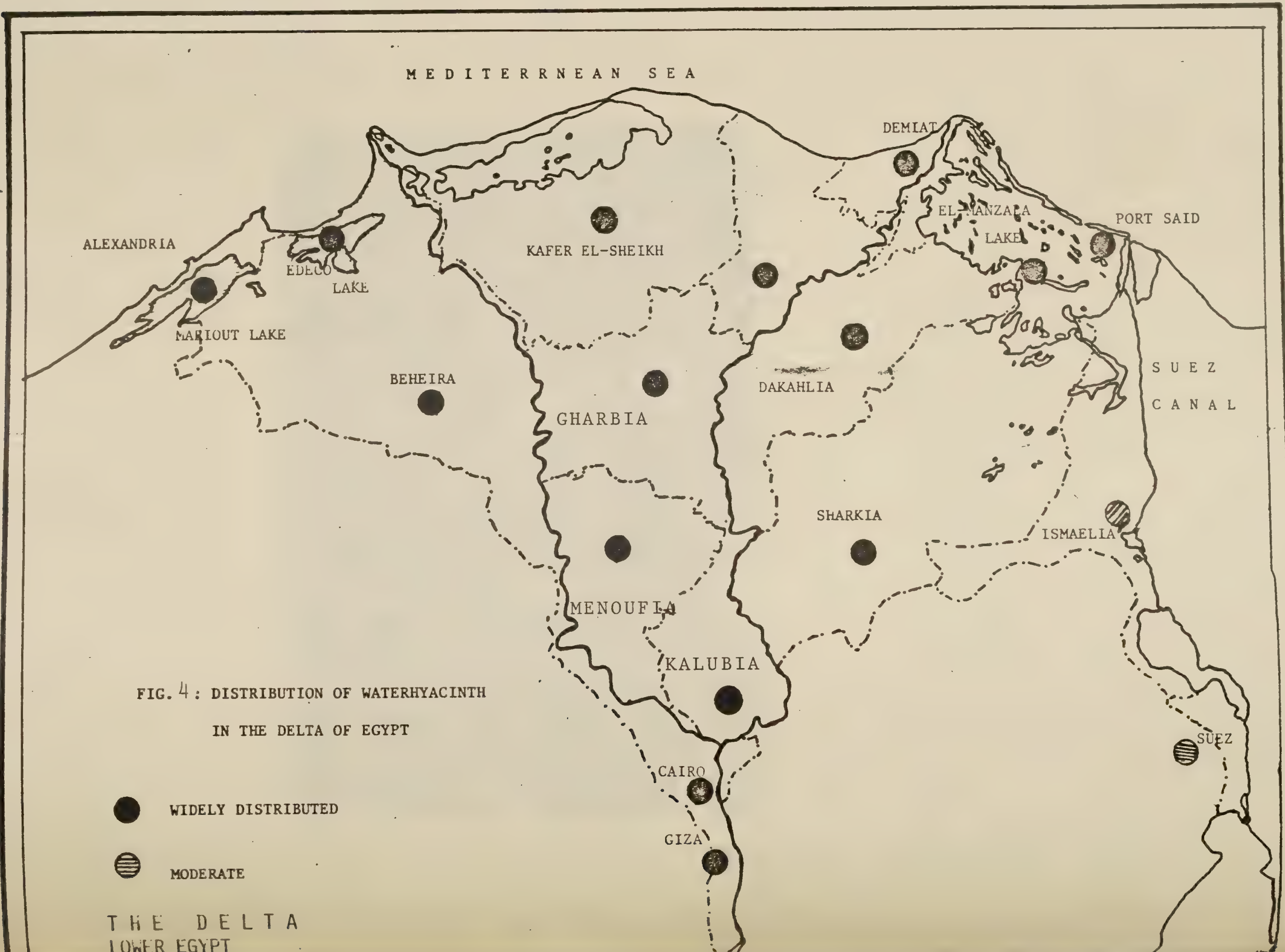


FIG. 4 : DISTRIBUTION OF WATERHYACINTH IN THE DELTA OF EGYPT

Fig. (5): Wooden frame of 50 x 50 cm for sampling of waterhyacinth and determining the number of plants / m^2 .

Table 1: Collections of waterhyacinth and organisms associated with In Egypt (September 13,1978 - June 30,1979)

Ser. No.	Date of collection	Locality	Governorate	No.of collecting sites	Associated organisms	Type of[1] Damage	Stage of[2] organisms
1	13.9.1978	Edeco Lake	Behiera	8	Root worms,	R	L,A
					snails	O	___
2	14.9	Mariout Lake	Alexandria	5	Root worms,	R	L,A
					snails	O	___
					Aphids(Possibly *Pentalonia nigronervosa*(Cop.) and *Aphis fabae*	Sd	N,A
3	14.9	Al-Amlak drainage	Alexandria	5	___	Sf	___
4	22.10	Giza	Giza	5	___	O	___
5	22.10	Fayium	Fayium	5	*Spodoptera littoralis*(Boisd.)	S	L

1 R= Few root feeding;O= No damage observed;Sd=Sucks plant juice and defoliates leaves;Sf=Symptoms of leaf feeding spots.

2 N=Nymphs ; L=Larvae ; A=Adults

Table 1: (cont.)

Ser. No.	Date of collection	Locality	Governorate	No.of colle-cting sites	Associated organisms	Type of[1] Damage	Stage of[2] organisms
6	28.10	Baher el-Baker	Port Said	1	--	0	--
7	30.10	Demiat	Demiat	2	--	0	--
8	30.10	Mansourah	Daqahlia	2	--	0	--
9	23.11	Mariout Lake	Alexandria	4	--	0	--
10	23.11	Mariout Lake	Alex.	4	--	0	--
11	24.11	Mariout	Alex.	4	--	0	--
12	15.12	Miet Ghamer	Daqahlia	4	--	0	--
13	15.12	"" ""	Daqahlia	4	--	sf	--
14	17.2.1979	Baher El-Baker	Port Said	1	--	0	--
15	6.4	Fayium	Fayium	3	Snails	0	--
16	6.4	Beni-Suef	Beni-Suef	3	Snails	0	--
17	11.4	Zakazik	Sharkia	2	--	0	--

Table 1: (cont.)

Ser. No.	Date of collection	Locality	Governorate	No.of colle-cting sites	Associated organisms	Type of[1] Damage	Stage of[2] organisms
18	11.4.1979	Kafer-Shoker	Qualuibia	2	--	0	--
19	12.4	Ismaelia	Ismaelia	1	Snails	0	--
20	20.4	Mansourah	Daqahlia	3	Snails	0	--
21	20.4	Demiat	Demiat	2	Snails	0	--
22	21.4	Kafer El-Sheikh	Kafer El-Sheikh	1	Snails	0	--
23	25.4	Tanta	Gharbia	1	--	0	--
24	25.4	Mariout	Alex.	4	Snails,worms	R	L,A
25	25.4	Ashmoon	Menoufia	1	Snails,worms	R	L,A
26	27.4	Giza	Giza	2	Snails,Beetles	0	--
27	28.4	Benha	Qualuibia	2	Predators,snails	0	--
28	28.4	Kafer Skoker	Qualuibia	2	Snails	0	--

Table 2: Measurements of different parts of waterhyacinth in nature .

(Different Localities of Egypt ,July 1978 - June 1979)

Ser. No.	Locality	Date	No. of plants	Length of root cm			No.of leaves per plant			Leaves					
										Length of petiole			Blade cm^2		
				Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
1	Edeco	13.9.1978	80	5.5	89	22.62	3	14	6.86	11.5	76	30.5	4	368.6	87.24
2	Mariout	14.9	50	5	54.2	20.13	3	19	7.15	14	56	32.1	2.64	190.4	73.62
3	Alexandria	14.9	50	4	45	14.83	4	15	7.72	7	85	40.3	5	530	165.18
4	Giza	22.10	50	6.2	74	25.62	4	14	7.82	12	58	30.63	6.25	255.75	85.68
5	Fayiuom	22.10	50	7	52	24.86	4	15	7.96	8	43.5	26.04	9	188	69.91
6	Port Said	28.10	10	10	31	16.95	6	10	8.6	41	62	50.7	20.25	201.5	103.77
7	Demiat	30.10	20	5.5	26	14.69	4	8	5.75	10	38	20.86	9.6	146.41	56.80
8	Daqahlia	30.10	20	21	33	21.29	5	11	6.9	20	49	36.57	22.5	200.22	98.24
9	Alex.	23.11	40	7	26	15.76	1	16	8.75	13	70	26.75	3	197.92	42.44
10	Alex.	23.11	40	5	77	20.44	5	13	8.05	4.1	60	20.14	9.24	169.4	48.07
11	Alex.	24.11	40	8.6	40	24.57	4	14	7.67	5.5	63	27.99	4.4	227.52	64.10
12	Daqahlia	15.12	40	5	56	24.69	4	14	8	10	65	32.72	7	201.6	71.30
13	Daqahlia	15.12	40	2	77	21.25	4	15	8.2	17	60	29.06	10.2	159.5	76.59
14	Port Said	17.2.1979	10	7	45	25.49	2	8	4.1	6	17	11.3	7.13	90.9	29.26

Table 3 : Collections of waterhyacinth and organisms associated with in Egypt (July 1979 - June 1980)

Ser. No.	Date of collection	Locality	Governorate	No.of colle-cting sites	No.of plants /m2	Associated organisms	Type of[1] Damage	Stage of[2] organisms
1	19.7.1979	Imbaba	Giza	2	80	Snails	0	___
2	25.7.	Fayiuom	Fayiuom	5	66	Snails	0	___
3	5 .8.	Mariout Lake	Alexandria	5	69	Root worms	R	L,A
4	2 .9.	Mansoura	Dakahlia	3	74	- -	0	- -
5	6 .9.	El-Kaaby	Fayiuom	3	86	*Aphis fabae*	sd	N,A
6	16.9.	Mariout Lake	Alexandria	5	63	- -	0	- -
7	22.9.	El-Hadeka	Fayiuom	5	111	*A.fabae Pentalonia nigronervosa*	sd.	N,A
8	13.10.	Fayiuom	Fayiuom	3	100	*Spodoptera littoralis*	sf	L

1 R= Few root feeding0=No damage observed, Sd= Sucks plant juice and defoliates leaves, Sf=Symptoms of leaf feeding

2 N= Nymphs, L=Larvae, A=Adults

Table 3 (Cont.) :

Ser. No.	Date of collection	Locality	Governorate	No.of collecting sites	No.of plants /m2	Associated organisms	Type of[1] Damage	Stage of[2] organisms
9	15.10.1979	El-Zarka	Demiat	2	100	Snails	Sf.	--
10	12.11.	Banha	Qualuibia	2	88	Snails	0	--
11	18.11.	Quisna	Menoufia	1	79	<u>A.fabae</u>	Sd	N,A
12	22.11.	Kafer-El-Sheikh	Kafer-El-Sheikh	3	84	Root worms & Snails	R,Sf	L,A
13	12.12.	Tookh	Qualuibia	4	58	Snails	0	Egg masses and A
14	12.12.	Berket El-Sabaa	Menoufia	2	56	Pentatomides	R,Sf	A
15	12.12.	Tanta	Gharbia	4	60	Snails	0	—
16	12.12.	Damanhour	Beheira	3	64	Heavely infested with snails on leaves and roots	0	Egg masses and A

Table 3 (Cont.):

Ser. No.	Date of collection	Locality	Governorate	No.of colle-cting sites	No.of plants /m2	Associated organisms	Type of[1] Damage	Stage of[2] organisms
17	6.1.1980	Fayoum	Fayoum	2	60	—	0	—
18	13.1.	Miet Ghamer	Dakahlia	2	58	Snails	0	—
19	13.1.	Demiat	Damiat	1	64	—	0	—
20	19.1.	Fayoum	Fayoum	1	40	—	0	—
21	22.1.	Mariout Lake	Alexandria	1	38	—	0	—
22	8.2.	Beni-Suef	Beni- Suef	3	40	Snails	0	—
23	16.2.	Manzala Lake	Dakahlia	3	56	—	0	—
24	18.2.	Zakazik	Sharkia	2	54	—	0	—
25	3 .3.	Baher El-Baker	Port Said	1	54	—	0	—

Table 4 : Number of plants/m^2 and measurements of different parts of waterhyacinth in Damanhour, Beheira governorate (February - September, 1980)

Ser. No.	Date	NO.Of Plants per m^2	Length of root cm			NO.Of leaves per plant			L e a v e s					
									Length of petiole			Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
1	17.2.1980	120	4	18.5	12.3	3	7	4.4	5	28	13.8	5	100.8	47.95
2	17.2	140	2	27.5	13.2	3	5	4.0	5.2	30	12.6	13.5	114.3	54.7
3	24.2	192	6.5	27.4	14.9	5	9	6.4	5.5	31.5	15.7	8 .6	10.8	53.1
4	9.3	220	6.5	21	13.9	4	11	6.8	6	24.5	17.9	6	96.3	38.46
5	16.3	228	3	19	10.0	4	7	5.8	7	30	15.1	14	99.7	38.1
6	23.3	248	3.5	18	13.4	3	8	5	5.5	19	11.2	5	44.4	25.5
7	30.3	236	9.0	23	12.5	3	6	4.8	9.5	31	19.8	15.1	63.7	36.0
8	30.3	264	6.5	24	11.0	5	8	6	10	27	17.9	11.2	72	35.7
9	6.4	240	11	28	20.2	5	8	6.0	7	38	24.0	14	100.7	56.6
10	6.4	248	6.5	33.6	18.1	3	8	6	6	34	20.8	17.6	95	47.4
11	13.4	208	6	25.5	18.0	5	7	5.6	8	34.5	20.2	6.2	109.3	47.9

Table 4: (Con.)

Ser. No.	Date	NO.Of Plants per m^2	Length of root cm			NO.Of leaves per plant			Leaves: Length of petiole			Leaves: Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
12	13.4.1980	176	11.5	30	22.9	6	6	6	5.2	36	19.7	17.2	100	42.3
13	20.4	168	17	33.5	12.7	3	7	5.2	13.5	41.5	26.1	25	172.5	66.8
14	20.4	144	5	36	21.9	3	8	5.0	14	39.5	25.3	9.6	110	77.6
15	27.4	208	15	23	21.2	5	6	5.4	7.3	39	28.9	20.3	119	69.3
16	27.4	188	8.5	30.5	20.4	4	7	4	17.5	44.5	32.7	29.2	161	71.1
17	4.5	204	12	20.5	17.7	5	7	8	8.5	42	28.8	26.1	115.5	57.3
18	4.5	200	17	24	19.3	5	7	5.8	4	30	21.5	39.6	147.9	83.3
19	11.5	208	15.5	29.5	18.8	3	7	5.4	8.6	38	27.1	28.2	151	76.7
20	26.5	204	14	28	19.1	4	8	5.5	7	26.5	20.6	29.9	162.3	79.6
21	1 .6	192	12.5	17.5	15.5	4	7	5.2	2.5	25.5	14.8	23.5	117.2	77
22	1.6	172	10	29	23	4	7	5.8	12	65	31.8	29.3	202.5	113.8

Table 4 : (Con.)

Ser. No.	Date	NO.Of Plants per m^2	Length of root cm			NO.Of leaves per plant			Leaves: Length of petiole			Leaves: Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
23	8.6.1980	172	9.7	17	12.9	3	6	4.6	4	26	18.6	42	152.8	77.3
24	8.6	192	10.3	21.3	15.1	4	7	5.6	5	31	18.7	18	163.0	82.0
25	16.6	136	13	34	23.9	5	7	6	10.3	57.2	29.9	16.6	205.8	128.1
26	16.6	176	7.7	21.3	15.36	3	6	4.8	5	22.6	14.7	22.3	120	77.2
27	22.6	172	11.5	28	16.5	4	6	5.2	4.0	34	21.4	18.9	115.5	73.5
28	22.6	152	18.5	24	22.3	4	6	5.0	6.5	39	21.0	18.0	172.5	107.2
29	1.7	168	22.0	27.2	25.0	4	7	5.6	12.4	30.0	21.8	23.9	172.5	84.5
30	1.7	152	13.0	26.3	19.1	4	7	5.2	6.2	24.5	17.0	11.6	88.2	42.5
31	6.7	152	4.0	22.2	11.4	2	7	3.8	8.0	31.5	20.6	10.2	119.5	58.3
32	6.7	136	17.7	24.2	20.8	4	6	5.2	10.5	48.5	35.7	35.2	240.2	143.2
33	15.7	112	20.2	37.0	28.4	5	7	5.8	11.0	37.0	24.9	5.3	138.7	60.9

Table 4 : (Con.)

Ser. No.	Date	No. of Plants per m^2	Length of root cm			No. of leaves per plant			Leaves: Length of petiole			Leaves: Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
34	15.7.80	128	6.2	28.5	16.8	4	8	6.0	3.2	38.0	22.9	5.0	145.1	57.3
35	20.7	164	13.2	24.2	16.3	3	5	4.2	5.0	19.0	12.2	13.6	100.7	48.8
36	20.7	148	6.0	31.0	17.9	4	5	4.4	3.5	22.3	15.3	28.8	111.2	71.4
37	27.7	144	9.3	33.0	17.2	3	5	4.2	3.0	17.0	11.1	6.0	75.7	49.6
38	27.7	160	14.2	30.2	21.7	4	5	4.4	7.5	23	12.8	20.2	128.7	61.4
39	2.8	160	7.0	24.0	15.6	4	5	4.4	2.3	22.3	12.5	7.5	76.3	48.9
40	2.8	168	11.5	23.5	17.5	3	5	4.4	3.5	25.5	13.5	12.2	103.0	60.6
41	8.8	136	8.0	74.0	28.2	3	7	4.6	2.0	10.4	7.2	9.2	46.5	28.7
42	8.8	152	8.0	26.0	15.7	3	5	4.2	2.0	11.7	8.2	10.0	56.4	33.4
43	18.8	88	21.2	28.5	24.5	3	5	4.2	5.0	23.0	16.4	17.0	99.4	61.8
44	18.8	108	16.0	26.0	21.4	3	5	4.2	4.5	19.3	13.5	19.7	94.9	54.6

Table 4 : (Con.)

Ser. No.	Date	No. of Plants per m^2	Length of root cm			No.of leaves per plant			Leaves					
									Length of petiole			Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
45	25.8.80	196	7.0	16.0	11.4	3	5	4.2	7.5	14.0	11.4	9.6	77.6	43.2
46	25.8	136	13.0	29.0	22.2	4	5	4.4	15.0	57.0	33.6	34.6	210.0	115.1
47	15.9	152	18.5	25.5	23.6	3	4	3.4	9.3	20.4	13.9	32.9	117.1	63.4
48	15.9	168	13.2	31.3	19.1	3	5	4.4	2.0	20.2	12.0	22.4	216.2	61.0
49	1.10	160	13.5	27.0	19.5	4	5	4.4	9.3	22.5	14.6	22.9	110.7	61.0
50	1.10	136	14.3	22.0	19.5	4	7	5.4	4.5	22.0	15.1	24.4	105.1	66.6

Table 5 : Number of plants /m^2 and measurements of different parts of waterhyacinth in Mariot Lake Alex. governorate (August - November 1979)

Ser. No.	Date	No.of plants per m^2	length of root cm			No.of leaves per plant			Leaves: Length of petiole			Leaves: Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
1	5.8.1979	88	2.7	31.5	9.3	4	9	5.8	7.2	47.0	31.4	57.6	220.4	134.1
2	5.8	52	2.2	16.5	14.0	5	12	7.8	6.5	65.6	45.0	22.4	289.0	180.0
3	5.8	84	7.2	14.0	11.0	5	9	6.2	10.5	43.0	28.1	3.0	225.0	117.3
4	5.8	52	4.0	19.5	13.0	2	11	8.7	26.0	77.0	58.2	21.3	330.0	215.4
5	5.8	68	4.0	12.0	8.0	5	10	7.4	15.0	72.0	38.4	27.5	210.0	104.6
6	16.9	88	2.0	16.5	11.6	4	8	6.4	21.5	70.0	43.3	27.5	264.0	142.1
7	16.9	80	5.0	21.5	11.7	4	10	5.8	16.0	70.5	43.2	6.0	231.0	135.2
8	16.9	68	2.0	19.0	11.4	4	10	7.4	27.0	76.0	51.0	8.0	279.0	129.7
9	16.9	76	1.5	17.0	9.2	2	9	4.9	10.0	58.0	38.9	22.5	273.6	141.0
10	24.9	88	4.0	11.0	8.0	4	6	5.0	15.0	58.0	37.9	6.0	189.0	111.8
11	24.9	96	10.0	18.0	14.6	5	7	5.4	22.0	72.0	46.7	30.0	263.5	151.7
12	24.9	132	8.0	17.0	11.0	4	6	5.2	16.0	50.0	35.6	30.0	255.0	123.8

Table 5: (Con.)

Ser. No.	Date	No.of Plants Per m^2	Length of root cm			No.of leaves per plant			L e a v e s					
									Length of petiole			Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	aver.
13	24.9.1979	104	6.0	13.0	10.6	4	8	6.2	8.5	19.0	15.0	27.5	103.5	68.4
14	24.9	120	6.0	18.0	12.1	4	9	6.2	21.0	64.0	42.1	14.0	255.0	134.9
15	1.10	88	3.8	13.0	5.7	6	7	6.4	2.2	65.5	45.0	3.8	224.8	130.2
16	1.10	64	2.2	17.0	7.6	4	7	6.0	10.5	46.9	33.2	6.0	295.5	127.5
17	1.10	144	2.0	11.0	5.9	4	7	5.6	2.0	26.0	15.4	3.0	108.0	59.1
18	1.10	176	5.0	31.0	8.3	4	8	6.2	4.0	38.0	18.7	11.2	115.0	62.5
19	1.10	116	5.5	14.5	9.5	4	9	6.0	4.5	45.0	27.5	2.5	195.0	93.4
20	7.10	148	7.0	11.5	9.3	3	7	5.6	5.0	30.0	19.4	6.3	156.3	82.5
21	7.10	112	4.0	12.0	9.0	3	7	5.6	10.5	60.0	40.3	9.2	225.0	110.8
22	7.10	144	6.0	16.5	11.0	6	8	6.4	11.0	53.0	38.2	11.2	219.0	120.2
23	7.10	96	4.5	15.0	8.9	3	8	5.8	19.5	67.0	45.4	9.5	247.5	117.4
24	7.10	112	5.5	10.0	8.2	2	6	4.8	8.5	23.0	14.2	6.5	132.3	55.8

Table 5: (Con.)

Ser. No.	Date	No.of Plants per/m^2	Length of root cm			No.of leaves per plant			L e a v e s					
									Length of petiole			Blade cm^2		
			Min.	max.	Aver.	Min.	Max.	Aver.	Min	Max.	Aver.	Min.	Max.	Aver.
25	14.10.1979	108	7.5	10.0	8.7	6	8	6.6	18.0	65.0	43.7	43.2	164.7	97.3
26	14.10	136	5.5	14.0	11.2	5	7	5.8	8.0	41.0	24.3	19.2	156.0	85.9
27	14.10	88	2.0	12.0	7.2	4	8	5.8	13.5	71.0	49.8	45.5	194.4	129.4
28	14.10	152	6.5	12.5	9.3	4	6	4.8	6.0	22.5	16.1	30.0	181.3	103.6
29	14.10	96	7.0	12.7	9.3	5	6	5.6	11.0	41.0	27.7	59.5	166.7	103.6
30	21.10	76	7.0	15.0	11.3	5	8	5.8	22.0	83.5	59.0	16.0	231.0	102.4
31	21.10	108	6.5	12.2	8.8	4	8	5.8	13.0	33.5	31.9	16.0	151.8	84.0
32	21.10	128	4.0	9.5	7.1	4	6	4.6	8.5	32.5	22.8	16.0	191.3	89.8
33	21.10	96	6.5	10.5	9.1	4	6	5.2	14.5	41.0	28.2	22.5	171.6	93.5
34	21.10	144	3.8	9.5	5.7	2	6	4.0	9.5	17.0	14.5	12.2	90.3	59.4
35	28.10	68	3.0	11.2	6.8	3	6	4.0	4.9	52.0	23.9	13.3	248.0	124.5
36	28.10	108	5.6	10.5	8.5	3	6	4.4	16.0	26.0	20.8	20.3	122.9	78.3
37	28.10	92	6.0	13.5	8.7	4	10	6.4	8.6	39.0	26.4	23.4	195.8	94.2

Table 5 : (Con.)

Ser. No.	Date	No. of Plants per m^2	Length of root cm			NO. of leaves per plant			Leaves					
									Length of petiole			Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
38	28.10.1979	136	6.0	9.5	8.0	4	5	4.8	3.0	10.0	7.4	9.5	54.9	33.1
39	28.10	84	4.0	12.5	6.2	3	10	5.6	15.5	67.0	44.3	54.6	234.0	132.1
40	4.11	116	5.6	17.2	10.0	3	7	4.8	5.5	13.2	10.0	7.8	68.0	40.3
41	4.11	100	6.0	17.0	11.1	5	7	5.6	2.5	31.0	14.6	16.0	129.8	58.4
42	4.11	88	9.0	17.0	13.2	5	8	6.8	11.5	35.0	25.5	33.6	118.6	78.8
43	4.11	104	7.2	19.1	12.4	4	7	5.8	5.0	24.0	18.7	14.0	118.3	73.7
44	4.11	168	7.0	22.5	12.6	3	6	5.0	4.2	19.5	11.7	10.2	61.6	33.9
45	11.11	96	8.0	20.0	13.8	5	8	6.2	6.0	52.0	41.9	9.5	210.2	130.1
46	11.11	76	8.5	17.5	11.3	5	8	6.0	5.0	68.0	44.8	13.4	255.7	128.0
47	11.11	80	8.0	10.0	9.1	5	8	6.2	4.0	61.5	41.3	28.6	184.8	112.5
48	11.11	80	3.4	18.6	9.5	4	8	5.8	4.0	69.0	37.9	14.3	288.8	142.0
49	11.11	72	11.2	17.0	14.4	5	9	6.6	4.1	48.0	27.6	13.3	211.7	84.9

Table 6 : Number of plants /m^2 and measurements of different parts of waterhyacinth in Fayoum governorate(September - November 1979)

Ser. No.	Date	No.of plants per m ^{2}	Length of root cm			No.of leaves per plant			Leaves: Length of petiole			Leaves: Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
1	6.9.1979	92	10.8	16.0	21.7	4	6	5.2	10.0	33.0	24.5	16.0	159.9	89.7
2	6.9.79	100	18.0	27.5	21.8	4	10	7.2	6.0	26.5	28.7	8.7	133.8	64.3
3	6.9.79	68	5.5	18.5	10.4	3	12	6.9	8.0	23.5	12.2	10.5	110.0	54.4
4	6.9.79	92	6.0	39.0	18.I	4	10	6.1	6.8	40.5	25.5	5.8	197.2	97.3
5	6.9.79	100	18.0	27.5	21.8	4	10	7.2	5.5	27.0	17.4	8.7	156.0	71.5
6	22.9.79	116	6.0	18.0	12.8	3	6	4.8	7.0	15.5	11.3	10.5	82.4	42.8
7	22.9.79	92	6.8	44.7	26.4	3	12	8.2	4.0	26.0	15.4	7.0	77.6	50.9
8	22.9.79	156	9.0	47.5	28.5	5	11	7.4	2.5	36.0	19.9	11.9	100.7	55.7
9	22.9.79	132	11.6	36.0	22.0	4	9	6.2	8.0	34.2	23.5	5.0	126.0	66.7
10	22.9.79	60	11.4	63.6	35.5	6	8	7.2	8.8	55.0	38.0	11.4	195.0	89.2
11	6.10.79	156	6.0	16.0	11.3	5	6	5.8	11.0	32.0	20.7	9.0	115.0	67.3
12	6.10.79	92	8.0	25.0	14.8	4	6	5.6	26.0	72.0	54.3	56.0	229.5	139.3

Table 6 : (Con.)

Ser. No.	Date	No. of plants per m^2	Length of root cm			No. of leaves per plant			Leaves					
									Length of petiole			Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
13	6.10.1979	116	3.0	42.0	23.2	2	7	4.6	9.0	58.0	35.7	6.0	196.0	101.6
14	6.10.	144	4.0	10.0	7.6	3	5	4.2	11.0	28.0	20.9	9.0	99.0	59.0
15	6.10.	128	10.0	22.0	15.4	3	6	4.2	6.5	13.0	10.2	6.0	61.8	35.9
16	13.10.	108	4.0	16.0	10.4	3	7	4.4	4.0	33.0	15.7	10.5	110.0	59.3
17	13.10.	128	13.0	29.0	22.6	5	6	5.8	20.0	50.0	36.9	64.0	156.0	110.5
18	13.10.	96	11.0	51.0	32.8	4	6	5.2	19.0	73.0	47.9	39.0	270.0	145.1
19	13.10.	156	6.0	18.0	13.4	3	6	4.4	8.0	30.0	23.2	33.0	120.0	80.1
20	13.10.	128	18.0	30.0	22.8	4	8	6.0	20.0	43.0	31.9	6.0	138.0	78.4
21	22.10.	116	12.0	26.0	18.2	3	7	5.2	8.0	34.0	19.2	24.0	110.0	56.7
22	22.10.	148	13.0	20.0	15.8	4	6	5.0	10.0	27.0	19.4	32.0	118.	75.2
23	22.10.	100	5.0	53.0	22.6	5	8	6.4	12.0	45.0	32.0	20.3	175.0	84.2

Table 6: (Con.)

Ser. No.	Date	No. of plants per m^2	Length of root cm			No. of Leaves per plant			Leaves: Length of petiole			Leaves: Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
24	22.10.1979	76	9.0	54.0	30.8	5	8	6.2	10.0	60.0	47.8	36.0	195.5	128.8
25	22.10.	140	15.0	63.0	31.8	6	11	7.6	14.0	46.0	34.9	12.0	169.0	115.5
26	30.10.	180	7.0	21.0	17.2	4	6	5.0	2.5	22.0	14.4	14.0	77.0	50.1
27	30.10.	116	8.0	28.0	21.8	4	7	6.0	6.5	37.0	20.0	18.0	136.5	71.1
28	30.10.	100	14.0	39.0	26.6	6	9	7.2	5.0	40.0	24.2	18.0	156.0	69.1
29	30.10.	132	13.0	22.0	17.2	5	6	5.4	6.0	48.0	27.1	25.0	110.0	82.2
30	30.10.	88	10.0	35.0	24.0	4	9	6.4	7.0	42.0	31.0	6.0	120.0	71.4
31	7.11.	140	6.0	15.0	11.8	3	6	5.0	2.0	29.0	18.3	3.0	118.8	61.4
32	7.11.	104	7.0	40.0	19.2	3	6	4.6	5.0	56.0	34.2	49.0	182.0	113.1
33	7.11.	188	6.0	29.0	17.6	3	9	6.0	3.0	16.0	10.0	12.0	77.0	46.2
34	7.11.	108	8.0	37.0	26.0	4	8	6.2	6.0	48.0	31.0	22.5	169.0	115.7
35	7.11.	128	10.0	32.0	22.0	5	8	6.2	17.0	49.0	36.1	36.0	187.5	113.6

Table 6 : (Con.)

Ser. No.	Date	No.of plants per m^2	Length of root cm			No. of leaves per plant			Leaves					
									Length of petiole			Blade cm^2		
			Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
36	17.11.1979	96	8.0	17.0	12.6	6	4	5.4	4.0	34.0	22.2	1.0	95.0	56.9
37	17.11.	88	6.5	17.0	12.4	3	6	4.6	6.0	17.0	10.5	12.0	71.3	47.6
38	17.11	92	15.0	16.0	19.8	6	7	6.8	5.5	33.0	25.6	35.8	90.0	49.5
39	17.11	108	7.0	23.0	12.4	3	5	4.8	9.0	33.0	23.3	27.5	120.0	72.2
40	17.11	76	7.0	18.0	12.6	3	6	4.8	4.0	26.0	17.3	20.3	108.0	67.8

FIG. 6 : FLUCTUATION NUMBER OF PLANTS PER m^2 DURING THE PERIOD FEBRUARY - OCTOBER 1980 IN DAMANHOUR, BEHEIRA GOVERNORATE

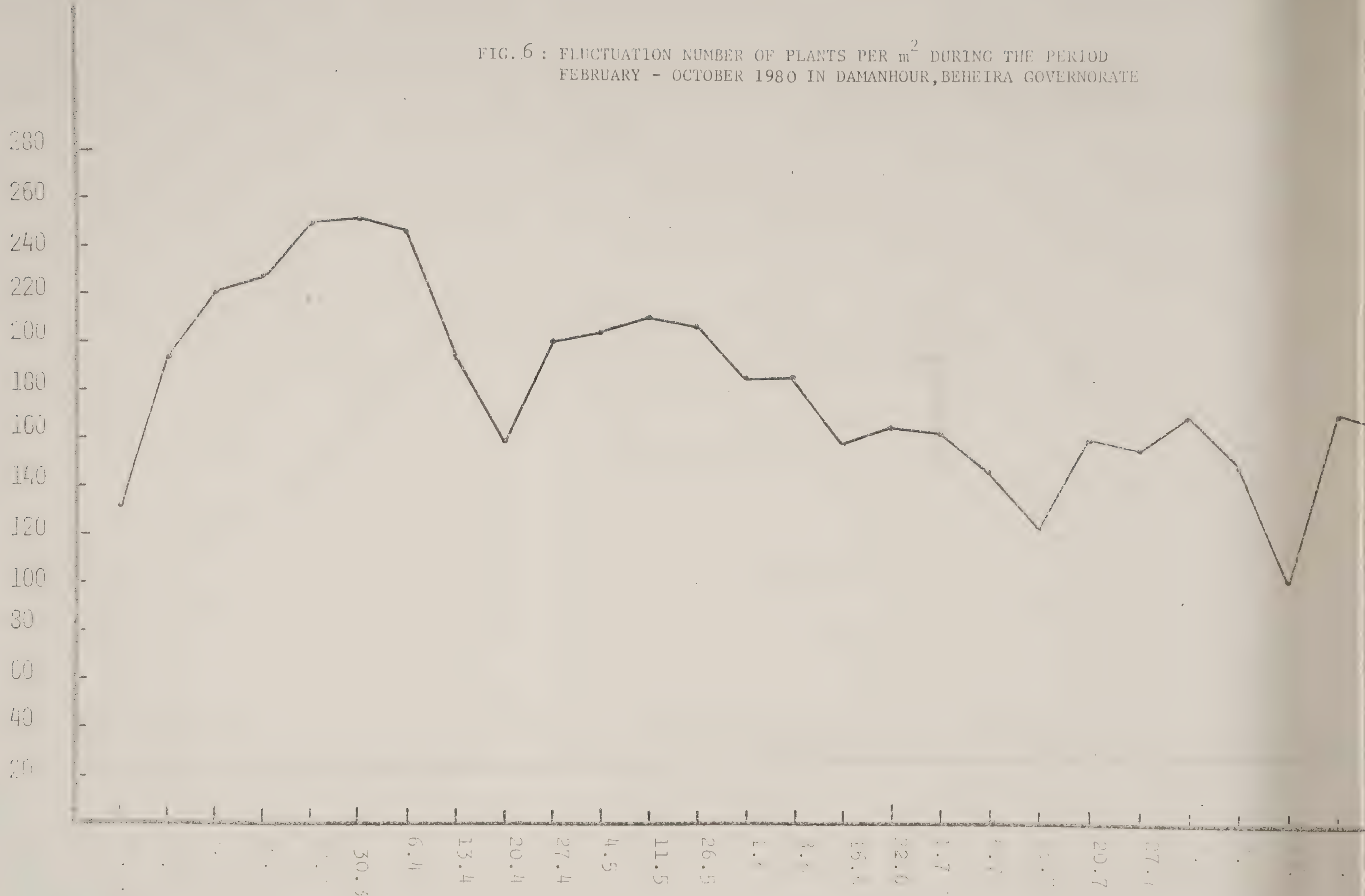
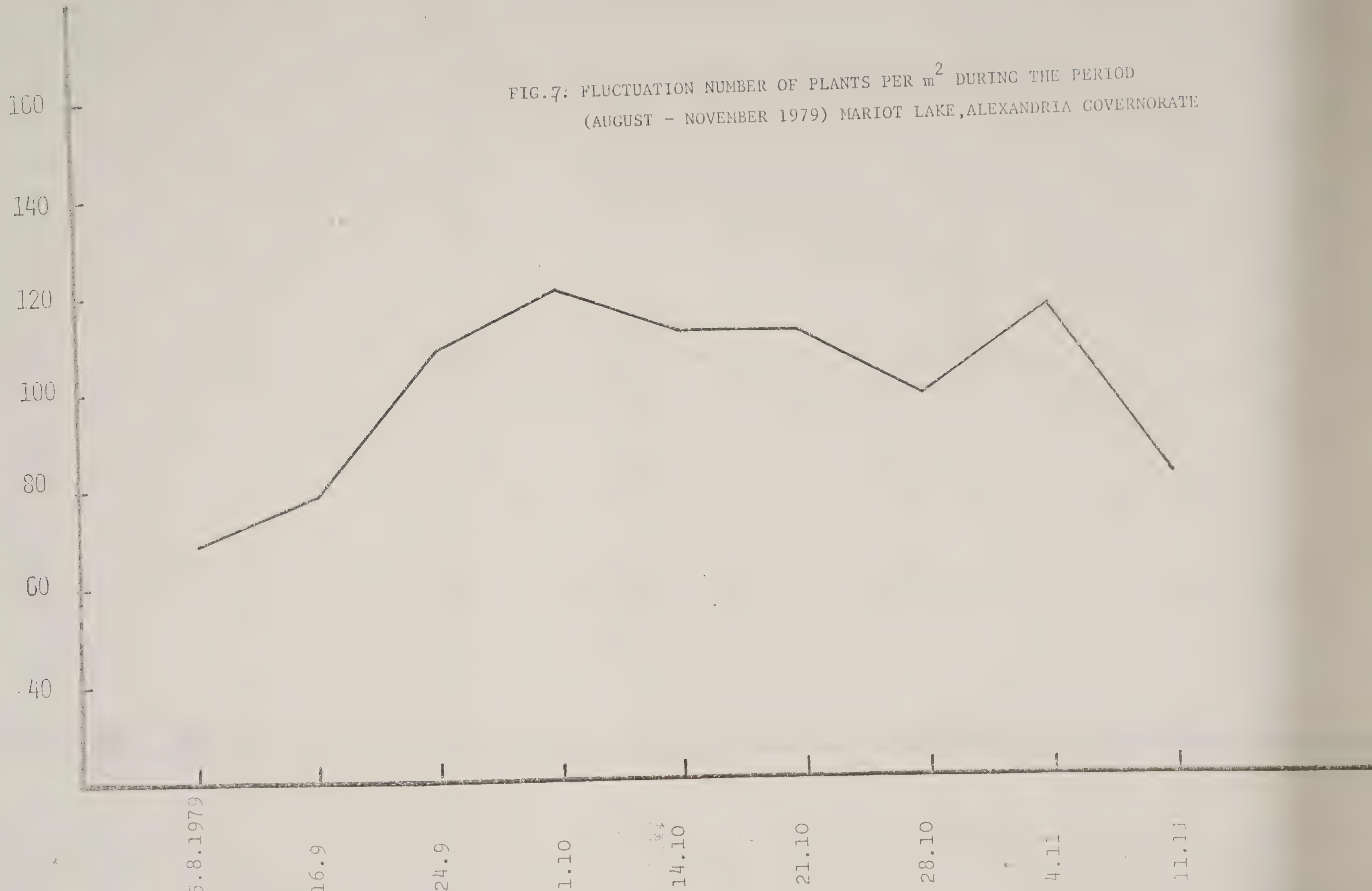


FIG. 7: FLUCTUATION NUMBER OF PLANTS PER m^2 DURING THE PERIOD (AUGUST - NOVEMBER 1979) MARIOT LAKE, ALEXANDRIA GOVERNORATE



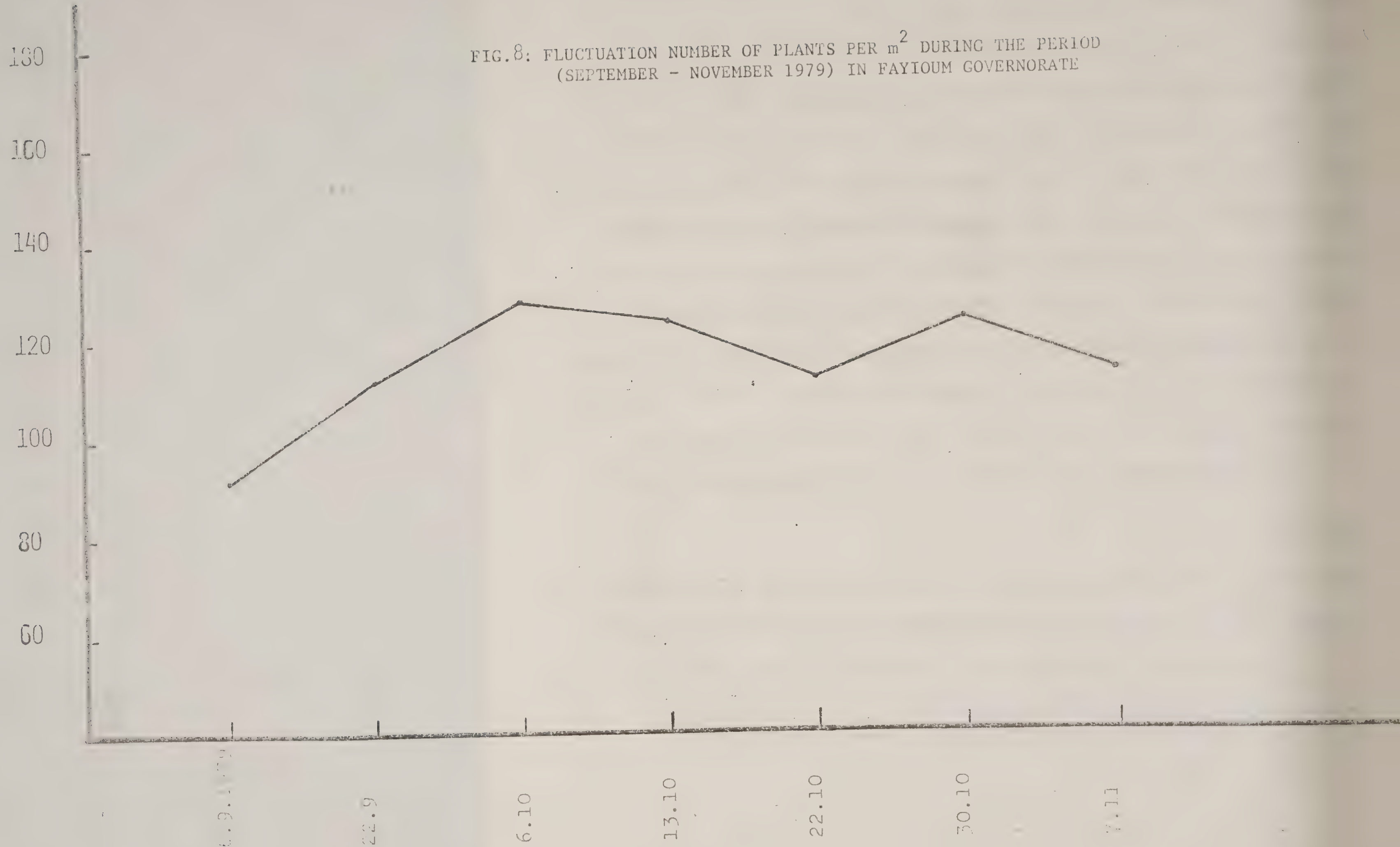


FIG. 8: FLUCTUATION NUMBER OF PLANTS PER m^2 DURING THE PERIOD (SEPTEMBER - NOVEMBER 1979) IN FAYIOUM GOVERNORATE

SERVEY WATERHYACINTH AND ASSOCIATED ORGANISMS IN EGYPT :

As it was planned in the proposal of the project, survey of the occurrence and abundance of waterhyacinth and associated organisms had to be continued during the project period.

Field trips were conducted to most regions of the country. (Maps Fig. 3&4). Number of collecting sites were selected in each locality. Preliminary studies on the seasonal rate of growth of waterhyacinth were conducted in three different localities, (Beheira and Alexandria governorates) representing lower Egypt and Fayoum governorate representing Middle Egypt. Samples were taken by placing a wooden frame 50 cm x 50 cm. Fig. 5. All plants within the frame were counted to express number of plants per $\frac{1}{4}m^2$. Five to ten whole plants were collected from each site and examined _in sita_. Roots and leaves of each plant were measured. Results obtained are shown in Tables (1 to 6) and Figs. (6-8).

Data summarized in tables 1&2 seems to indicate the following :-

1- During the period of this work, almost about 28 field trips were made to different governorates of Egypt to determine the occurrence of waterhyacinth and it's distribution. Results obtained indicated that waterhyacinth

is widely distributed in almost all governorates of lower Egypt and Mediterranean coast. In Middle Egypt, water-hyacinth proved to occur from Cairo to Minya governorates and absolutely not in the most southern governorates of Assuit, Sohag, Quena, Asswan and Nasser's Lake.

- It has to be mentioned that during this period no organisms proved to be specific for feeding on, and controlling water-hyacinth in Egypt. It was found that different species of snails and worms are associated with the plants without causing any serious damage. No real injury or feeding spots found on the plants with the only exception of severe damage caused by Spodoptera littoralis larvae in Fayoum governorate which known in Egypt as cotton key pest. Furthermore, heavey infestation with aphids mostly Pentalonia nigronervosa (Coq.) was found on waterhyacinth during September and October.

- The root length of 540 whole plants ranged between a minimum of 2 cm and a maximum of 89 cm with an average ranged between 14.69 cm and 25.62 cm.

- The number of leaves per plant ranged between a minimum of one leaf and a maximum of 19 leaves with an average ranged between 4.1 and 8.75 leaves per plant.

- The petiole length measured a minimum of 4.1 cm and a

maximum of 85 cm with an average ranged between 11.3 cm and 50.7 cm.

6- The total blade of leaf area measured a minimum of 2.6 cm^2 and a maximum of 530 cm^2 with an average ranged between 29.26 cm^2 and 165.18 cm^2.

Data summarized in tables 3-6 seem to indicate the following :-

1- During the period of this work, a total of about 67 field trips were conducted. Out of which 21 surveying trip were conducted to almost most governorates of Egypt, 28 to Damanhour, Beheira governorate, 10 to Mariout Lake and 8 were conducted to Fayoum governorate. Results obtained insure the previous results given in the first annual report which indicated that waterhyacinth are widely distributed in all governorates of lower Egypt and meditrrenean coast infesting the lakes, irrigation and drainage canales in cultivated and noncultivated areas. Waterhyacinth in southern governorates of Egypt proved to be widely distributed from Cairo to Minya governorates and still absolutely not in the most southern governorates of Assuit, Sohag, Quena, Asswan and Nasser's Lake.

2- Survey of different organisms associated with waterhyacinth in different parts of Egypt during this period showed that

no specific organisms occured on the plants. Two species of aphids Aphis fabae and Pentalonia nigronervosa were found infesting the plants in Fayoum and Minufiya governorates during September and November respectively. Severe damage caused by the cotton leaf worm Spodoptera littoralis was occured in Fayoum during October. Few numbers of pentatomid bugs have been found feeding on roots and leaves of the plants in Minufiya governorate during September. Snails were the most common organisms infesting waterhyacinth. The plants were heavely infested by immature stages (egg masses) of the snails mainly on the roots and leaves during December in Damonhour Beheira governorate.

It is to be mentioned that, after the two years survey it could be indicated that in Egypt there is no specific biological control agent seemed to be used for the control of waterhyacinth. Comments received from the cooperating scientist indicated the termination of surveying the weed and associated organisms since this part of the study has been covered. On the cooperating scientist request, survey of the Eurosia Water-Milfoil (Myriophyllum spicatum L.) and associated organisms had been started. Previous servey made by several investigators indicated that the weed is very rare in Egypt and occures only in Kantara near Port Said. Our preliminary survey did not record the occurence of the weed

in the surveyed localities.

3- In Damanhour, Beheira governorate, the number of plants per m^2 (Fig. 2) ranged between a minimum of 88 and maximum of 264 plants per m^2 with an average of 172.6 plants per m^2. In general, the maximum numbers of plants per m^2 occured during the growing season from March to June. Lesser numbers counted late in the season from July to October when the plants were larger in size and less reproductive.

The root length of about 280 plants collected from Damanhour ranged between a minimum of 2 cm. and a maximum of 74 with an average ranged between 10.0 cm.and 28.4 cm. The number of leaves per plant ranged between a minimum of 2 and a maximum of 11 leaves with an average ranged between 3.4 and 8.0 leaves per plant. The petiole length measured a minimum of 2 cm and a maximum 57.2 cm with an average ranged between 7.2 cm and 35.7 cm. The total blade leaf area measured a minimum of 5 cm^2 and a maximum of 240.2 cm^2 with an average ranged between 25.5 cm^2 and 143.2 cm^2.

4- In Mariot Lake, Alexandria governorate the number of plants per m^2 Fig. 3 ranged between a minimum of 52 and a maximum of 176 plants per m^2 with an average of 101.9

plants per m^2. The root length of about 260 plants examined ranged between a minimum of 1.5 cm and a maximum of 31.5 cm with an average ranged between 5.7cm and 14.6 cm. Number of leaves per plant ranged between a minimum of 2 and a maximum of 12 with an average ranged between 4.5 and 8.7 leaves per plant. The length of petiole measured a minimum of 2.0 cm and a maximum of 83.0 cm with an average ranged between 7.4 cm and 59.0 cm. The leaf blade area measured a minimum of 2.5 cm^2 and a maximum of 330.0 cm^2 with an average of 33.1 and 215.4 cm^2.

5- In Fayoum, Fayoum governorate, the number of plants per m^2 (Fig. 4) ranged between a minimum of 60 and 188 plants per m^2 with an average of 114.6 plants per m^2. The root length of about 200 plants examined ranged between a minimum of 3.0 cm and a maximum of 63.6 cm with an average ranged between 7.6 cm and 35.5 cm. The number of leaves per plant ranged between a minimum of 2 and a miximum of 12 leaves per plant with an average ranged between 4.2 and 8.2 leaves per plant. The length of petiole measured a minimum of 2.5 cm and a maximum of 73.0 cm with an average ranged between 10 cm and 54.3 cm. The leaf blade area measured a minimum of 1.0 cm^2 and a maximum of 229.5 cm^2 with an average ranged between 35.9 cm^2 and 145.1 cm^2.

THE OCCURRENCE OF WATERHYACINTH IN THE MOST SOUTHERN GOVERNORATES OF EGYPT AND ASSOCIATED ORGANISMS :

During the last period of this project, occasional survey of waterhyacinth and associated organisms were conducted in different localities in the country. Observations obtained from more than 58 field trips, indicated that, the different organisms found to be in association with waterhyacinth in Egypt did not differ too much from those previously reported.

One important point came out from the survey that waterhyacinth infestation seems to be expanding south of Minya governorate (previously recorded as the last infested area in southern Egypt), and reached almost to Assuit governorate south of Minya. This result is not completely confirmed and it is suggested to conduct several surveying trips to the most southern governorates of Egypt during the growing season of waterhyacinth inorder to confirm this observations.

As it was concluded before, waterhyacinth is widely distributed in all governorates of lower Egypt including Cairo and Giza. In upper Egypt the weed was recorded by both our research team and the official reports of the Ministry of Irrigation, only in Fayioum, Beni-Suef, and Minya. It had never been reported in the most southern

governorates of Assuit, Sohag, Quena and Aswan. At the end of 1980, individual plants have been seen in Assuit floating in the River Nile and main Canals with the water current from south to north. At that time surveying trips conducted to Assuit, Sohag, Quena and Aswan including sailing and aireal survey of the High Dam lake, indicated that these areas were completely free from waterhyacinth infestation.

So, several surveying trips were conducted to Minya, Assuit, Sohag and Quena. The main River, Canals, drainages and small irrigation canals within the planting areas were checked. Informations obtained are given in Table (7).

This particular survey was conducted and continued for the extension period in upper Egypt. It was previously reported that waterhyacinth is widely distributed in all governorates of lower Egypt including Cairo and Giza. In upper Egypt, the weed was recorded only in Fayioum, Beni-Suef and Minya and not in the most southern governorates of Egypt. Unfortunately, it was noticed that during the last 3 years, waterhyacinth covered almost all governorates of Egypt with the only exception of Aswan governorate which planned to be surveyed during the following periods.

Eleven field trips were conducted to upper Egypt to determine the distribution of waterhyacinth in the most

southern governorates of the country. The survey indicated that, recently waterhyacinth infested also the most southern governorates of Egypt, Assuit, Sohag, and Quena. In Aswan, individual waterhyacinth plants were observed accidentally floating in the main River from south to north. It is to be mentioned that during the present survey, 75 sites were examined in upper Egypt. In general conclusion, waterhyacinth infestations recently recorded in the most southern governorates of the country were scattered in small patches and still not intensively distributed.

The number of plants per meter^2 recorded averaged between 18-40 plants. It has to be mentioned that during the growing season (March-August) large number of waterhyacinth plants were counted/m^2 since new growing plants started to emerge.

During the last period, 255 whole plants were measured _in sita_. The root length ranged between a minimum of 3.5 cm and a maximum of 79 cm with an average ranged between 32.3 cm and 59.3 cm. The number of leaves per plant ranged between a minimum of 3 and a maximum of 10 leaves with an average ranged between 3.7 and 6.8 leaves per plant. It has to be mentioned that the number of leaves per plant was relatively higher during the growing season.

Table (7): Survey of waterhyacinth in the most southern governorates of Egypt. (July 1982-June 1983).

Ser. No.	Date of Collection	Governorate	No. of collecting sites	Rate of waterhyacinth infestation	No. of plants/m^2
1	28.7.1982	Minya	12	++	36
2	3.8.	Assuit	8	+	22
3	6.8	Sohag	3	+	18
4	24.8	Assuit	5	+	28
5	13.9	Sohag	4	+	32
6	20.10	Quena	8	-	-
7	9.2.1983	Assuit	10	+	40
8	12.3.1983	Assuit	6	++	32
9	15.3	Sohag	4	+	18
10	17.3	Quena	6	+	-
11	8.6	Assuit	9	++	30
			75		

Three to five whole plants were taken from each collecting site. Roots, petioles and leaf blade of each plant were measured. Data obtained is given in Table (8).

Table (8): Measurements of different parts of waterhyacinth plants collected from the governorates of upper Egypt.

Ser. No.	Governorate	Date	No. of plants measured	Root length cm			No. of leaves per plant			Leaves					
										Petiole length			Blade area cm^2		
				Min.	max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver
1	Minya	28.7.82	40	8	69	32.3	3	10	6.3	9.2	16	13.1	2.6	188	70.1
2	Assuit	3.8	32	17	79	44.6	3	9	5.7	16	56	34.4	16	360	91.2
3	Sohag	6.8	15	11	72	35.8	4	7	5.3	18	89	51.9	22	432	90.5
4	Assuit	24.8	21	7	69	41.3	4	9	6.8	14	79	48.9	18	420	89.0
5	Sohag	13.9	16	10.5	74	48.3	3	7	4.2	7.5	42	23.1	9.6	189	67.3
6	Assuit	9.2.83	35	12.5	78	59.3	3	5	3.7	19	48	29.1	10.5	170	44.3
7	Assuit	12.3	24	11.0	69.5	38.6	3	8	5.4	7	52	31.4	8	185	52.3
8	Sohag	15.3	12	9.5	75	48.7	4	9	5.5	13	87	52.3	12	330	118.5
9	Quena	17.3	24	3.5	52	35.4	3	5	3.8	16	88	51.1	6	280	72.4
10	Assuit	8.6	36	10	69	50.4	3	8	5.5	15	88	60.1	12	456	218

Ser. No.	Date of collection	Governorate	No. of collecting sites	Associated organisms	Type of[1] damage	Stage of[2] organisms
1	28.7.1982	Minya	12	Snails Ampullaria ovata*	0	-
2	3.8	Assuit	8	Mites Entetranvchus orientalis (Klein)**	Sd.	N,A
3	6.8	Sohag	3	Snails	0	
4	24.8	Assuit	5	Mites Entetranychus crientalis** E.anneke Meyer** Entetranychus sp.** Euseins delhiensis** (Narayananol Kanr) Snails: A.ovata* Valvata nilotica*	Sd.	N,A
5	13.9	Sohag	4	Root worms S.littoralis	R sf	L,A L
6	9.2.1983	Assuit	10	-	-	-
7	12.3	Assuit	6	-	-	-
8	15.3	Sohag	4	-	-	-
9	17.3	Quena	6	Snails	-	-
10	8.6	Assuit	9	Snails	-	-

* Identifications made in Egypt.
** " " " Smithonian Institute, U.S.A.

1- R. Few root feeding; 0 = No damage observed; Sd. = Sucks plant juice and defoliates leaves; Sf= Symptoms of leaf feeding.

2- N = Nymphs. L = Larvae; A = Adults.

The petiole length measured a minimum of 7 cm and a maximum of 89 cm with an average ranged between 13.1 cm and 60.1 cm. The leaf blade area measured a minimum of 2.6 cm and a maximum of 456 cm^2 with an average ranged between 44.3 cm^2 and 218 cm^2.

On the other hand roots, petioles and leaves of each waterhyacinth plant in each site were examined for associated organisms and symptoms of feeding. Results obtained are given in Table (9).

During the reporting period, organisms associated with, or causing any damage to waterhyacinth were surveyed. Plants were examined in the nature, samples were dissected in the laboratory. Results obtained and shown in table 9 indicated that there are no specific organisms occurred on waterhyacinth plants recently infested the most southern governorates of Upper Egypt. This result agrees with our findings reported during our previous survey allover the country.

During the present survey, different species of snails were found to be associated with waterhyacinth in Minya, Assuit, Sohag and Quena. Two species were identified in Egypt as Ampullaria ovata and Valvata nilotica. In Assuit unspecific species of mites were found heavily infesting waterhyacinth. Samples have been

identified in U.S.A. as Acari: Tetranychidae

Eutetranychus orientalis (Klein)

Eutetranychus anneke Meyer

Eutetranychus sp.

These species were determined by E.W. Baker of Systematic Entomology Laboratory, U.S.D.A.

A fourth species was determined by H.A. Denmark, Gainsville, Florida as follows :

Acari

Phytoseiidae

Euseius delhiensis (Narayanan & Kaur)

Referring to the specialists of the Plant Protection Institute, Ministry of Agriculture, Egypt, this species is known as a predacious mite.

Spodoptera littoralis larvae were found in Sohag governorate heavily infesting waterhyacinth causing sever damage to the leaves.

It has to be concluded that, from the present survey waterhyacinth recently infested the most southern governorates of the country. By this results, waterhyacinth became a common aquatic weed infesting almost all governorates of Egypt. All organisms recorded infesting or associated with waterhyacinth proved to be unspecific organisms and in most cases, they are known as common pests of different crops in Egypt and some other countries.

INTRODUCTION OF THE TWO WEEVILS NEOCHETINA EICHHORNIAE WARNER AND NEOCHETINA BRUCHI HUSTACHE (COLEOPTERA, CURCLIONIDAE) TO EGYPT.

Neochetina eichhorniae was introduced to Florida from Argentina, tested and released in the nature in 1972 (Perkins 1973). In 1974 another species *N.bruchi* was intr-oduced also and released in the nature in Florida for control of waterhyacinth. (Perkins, Personal communication).

It was planned that the principal investigator had to visit Fort Lauderdale, Florida, for a period of about three weeks at the beginning of the project, meet the co-operating scientist, collect and train how to deal with and handle the two weevils *N.eichhorniae* and *N.bruchi* which they were going to be introduced and tested in Egypt as candidates for biological control of waterhyacinth.

During the period April 8-28, 1979 the principal investigator accompanied by Dr. Ted Center co-operating scientist of the project and his staff conducted several collecting trips to different parts of the state including Gainsiville, Tempa, Maiami and several other collecting sites. During that period 820 individuals of both *N.ichhor-niae* and *N.bruchi* were collected. Good knowledge and training about dealing with and handling these weevils have been obtained.

At the first of May 1979, a number of 820 weevils had been arrived in a very good condition, free from any infestation to our quarantine room in Egypt to start our host specificity tests and some biological studies on the weevils.

PRELIMINARY STUDIES ON *NEOCHETINA EICHHORNIAE* AND *N. BRUCHI* IN EGYPT :-

A- Review of Literature :-

1) Arthropods associated with or attacking waterhyacinth :-

Perkins (1973 & 1974) mentioned that more than 70 species of arthropods were found to feed on waterhyacinth in south America, the United States, and India. He divided those arthropods into categories based on the type of damage and put the adults of *Neochetina* spp. into the first category which considered as defoliators and external feeders. The most important pests mentioned are :- *Cornops* spp. (Orthoptera: Actididae), *Acigona infustella* (Walker) and *Epipagis albiguttalis* (Warren) (Lepidoptera: Pyralidae), *Arzama densa* Walker (Lepidoptera : Noctuidae), as potiole borers; *Orthogaiumna terebrants* Wallwork (Acarina: Galumnidae) as leaf tunnel producers; *Dyscinetus* spp. (Coleoptera : Scarabidae) as scavenger species which enhance the effect of attack by other insects. He added that this damage is also often amplified by pathogensand other less abundant

arthropods. Bennet (1967) indicated that in northern Brazil, waterhyacinth was attacked by a Galumnid mite, Curculionids, a Cecidimyiid, an Acridid and molluscs. He added that in Rio de Janeiro a heavy attack by the leaf hopper _Megamelus_ sp. (Delphacidae) was observed. Bennett (1968) mentioned that in South America and Trindad two pyralids, _Acigona ignitalis_ (Hmps.) and _Epipagis albiguttalis_ (Hmps.) cause appreciable damage and appear adequately plant specific to warrant further investigations. He added that, similarly the leaf mining oribaled mite _Leptogalumna_ sp., the stem boring weevil _Neochetina bruchi_ Hust., the grasshopper _Cornops longicorne_ (Bruner) and the Dolichopodid fly _Thrypticus_ sp. He also indicated that in Jamacia, only _Leptogalumna_ sp. is considered of interest. The only species of interest encountered in British Honduras was a grasshopper, _Cornops_ sp. In Florida and Louisiana, the Noctuid _Arzama dense_ (Wlk.) was perior to the establishment of _Eichhornia_ and bred on _Potedria cordata_. Bennett and Zwolfer (1968) found during their survey in Northern South America and Trinidad the weevil _Neochetina bruchi_ Hulst (Curculionidae, Bagoini) attacking _E.crassipes_ at Belem, Marajao and Manaus. They also recorded _Acigona_ (Chilo) _ignitalis_ Hmps., Crambinae, _Epipagis albiguttalis_ Hmps., Pyralidae, _Cornops longicorne_ (Bruner), Tettigoniidae and _Leptogalumna_ sp. (This species has since been determined as _Orthogalumna terebrantis_ Wallwork, Galumnidae (Acarina). Bennett (1972) recommended _N.eichhorniae_ for release in areas where waterhyacinth is a problem. Spencer

(1974) mentioned that as a result of research in Argentina, only one species of weevil, N.eichhorniae Warner, has been released in Florida against waterhyacinth. Cordo and Deloach (1975) mentioned that the females of the mite Orthogalumna terebrantis Wall. oviposit only on their natural host plant, waterhyacinth Eichhornia crassipes. They added that this mite is common and often abundant in the field in Argentina on waterhyacinth. Center (1975) presented some new information on the release of Neochetina bruchi Hust. and N.eichhorniae Warner in Florida in 1973 - 1974. DeLoach (1975a) made an evaluation in Argentina of some arthropods as biological control agents of Eichhornia crassips. He arranged these arthropods based on their importance as biological control agents as follows : Neochetina bruchi Hust. N.eichhorniae Warner, Cornops aquaticum (Bruner) Orthogalumna terebrantis Wallwork. Fosse et al. (1976) investigated in Florida the effect of the polyphagous white amur fish (Ctenopharyngodon idella) and the monophagous weevil N.eichhorniae Warner in combination and alone on waterhyacinth. Results obtained indicated that combination of 278-1112 of fish plus 50 adult weevils/pool of surface area about 8 m^2 for a period of 10 weeks caused the greatest reduction in growth of the weed, followed by fish alone and weevils alone.

Fig. 9 : Distribution of waterhyacinth <u>Eichhornia crassipes</u> (Mart.) Solms in the world.

● Waterhyacinth is introduced

⊜ Waterhyacinth is originated

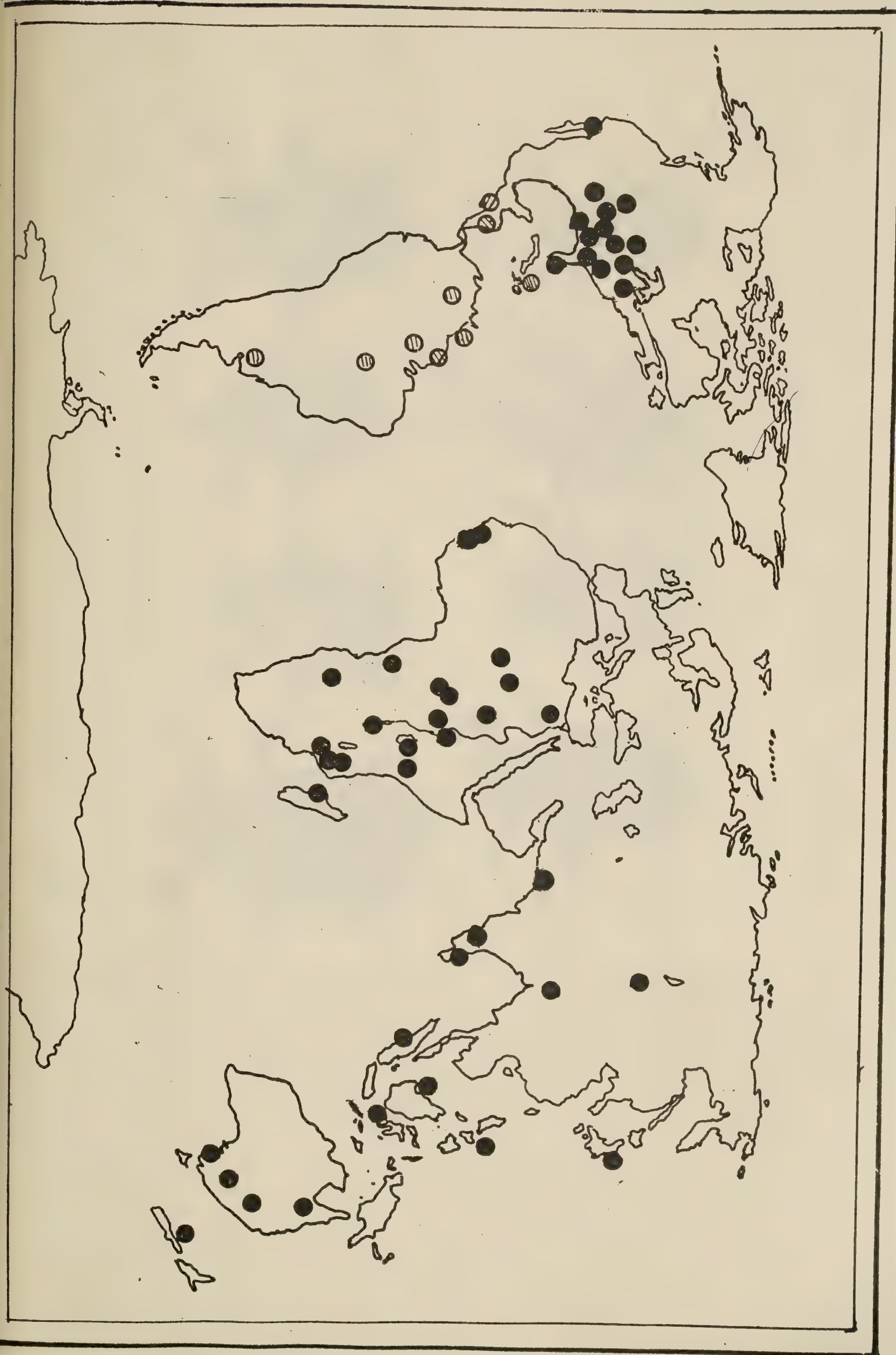


Fig.(10) : Dorsal view of the 4 species of Neochetina; N.n.sp.female (1),male (2);N.eichhorniae female (3),male (4);N.bruchi female (5), male (6);N.affinis female (7),male (8).

(Cited from DeLoach 1975b)

Fig.(10) : Dorsal view of the 4 species of Neochetina; N.n.sp.female (1),male (2);N.eichhorniae female (3),male (4);N.bruchi female (5), male (6);N.affinis female (7),male (8).

(Cited from DeLoach 1975b)

2- Biological Studies and Host Specificity Tests of N.eichhorniae and N.bruchi :-

a- Principal Taxonomic Characters :

The genus *Neochetina* that occurs on the plant family Pontedriaceae in South America is under tribe Bagoini, family Curculionidae, order Coleoptera. DeLoach (1975) mentioned that the genus *Neochetina* was erected by Hustache (1926) with the description of 2 new species, *bruchi* and *affinis*; and later he added a third, *gaudelupensis* (Hustache 1929). The principal characters for separating the 4 species of *Neochetina* are : 1) the location of the carina and markings of the elytra, 2) the form of the tubercles on the prosternum, 3) the distance between the front coxa, and 4) the size and shape of the rostrum. (DeLoach 1975). He added that with experience, the species can be identified with the naked eye by the lighter color and frequently present tan chevron of *bruchi*, and smaller size and darker color of *eichhorniae* (Fig.10,1-8).

NEOCHETINA BRUCHI HUSTACHE

Neochetina bruchi (Fig. 10, 5&6) was described by (Hustache 1926) as follows :

Medium size, length of male 4.18 mm (3.5 - 4 .5 mm), of female 4.61 mm (4.1 - 5.0 mm); brown, many individuals with light tan chevron on elytra, others with indistinct tan spots of elytral intervals 1,3,5 and 7; carina on elytral interval 1 short

(0.33 length of thorax) and located behind the anterior margin of the elytra a distance sub-equal to the length of the thorax; front coxa moderately separated (0.33 of the narrowest width of the rostrum); all 3 tubercles of prosternum behind front coxa well developed and sub-equal. Rostrum stout, slightly curved, suprascrobal groove indistinct in female, absent in male.

NEOCHETINA EICHHORNIAE WARNER

This species was described by Warner (1970). Small species, length of male 4.06 mm (3.4 - 4.5 mm), of female 4.52 mm (3.8-4.9 mm); dark brown to black without conspicuous markings; carina of 1st. elytral interval long (0.5 or more length of thorax) and located anteriorly (behind the anterior margin of elytra a distance of only 0.5 the length of thorax); front coxa approximate (separated by 0.1 the narrowest width of the rostrum); latero-posterior tubercles of posternum behind front coxa distinct but less developed than anterio-medial tubercle. Rostrum selender, of female strongly curved throughout of male strongly curved and distinctly expanded on distal 0.33, suprascrobal groove quite deep and prominent in female not present in male.

b) Biology and Host Range :

Andres & Bennet (1975) mentioned that any plant-feeding organism or parasite may be used to control aquatic weeds,

providing it does not harm plants value or creat undesirable imbalances in the plant community. The eggs of the species of Neochetina are laid beneath the epidermis in the petioles or lamina of the leaves of the host plant (DeLoach 1975). He added that the larvae of the species feed inside the petiole stems, and crowns of the host plant. He also indicated that N.bruchi and N.eichhorniae have three larval instars and mature larvae of both species leave their cells inside the crown of the plant and pupate underwater outside among the rootlets. He also added that N.bruchi and N.eichhorniae have a narrow host range that generally restricts their development of E.crassipes. Perkins & Maddox (1976) mentioned that in the laboratory tests with 25 plant representing 17 families in Argentina and 4 plant species in California, adults of Neochetina bruchi had a high preference for the target weed Eichhornia crassipes. DeLoach and Cordo (1976) mentioned that both N.bruchi and N.eichhorniae had 3 generations a year near Buenos Aires in Argentina. Peak populations of adults occurred in September, January, and April-May. They added that both species overwintered as adults, larvae and pupae. The maximum rate of oviposition occurred in October-November. N.bruchi was more abundant in spring and summer, and N. eichhorniae in autumn and winter. Both species damaged waterhyacinth (Eichhornia crassipes) throughout the year,

but maximum damage was done during the summer, when an average of 130 feeding spots/leaf were made by the adults and 30% of the petioles were damaged by tunnelling of the larvae. Fosse (1977) studied the mortality feeding, oviposition and adult emergence rates at temperatures fluctuating between 5 and 25, 10 and 30, 15 and 35, and 20 and 40°C. The highest mortality for both N.bruchi and N.eichhorniae occurred at 5-25 and 20-40°C and the lowest weevil mortality (41.2%) was observed at 15-35°C. Fosse and Perkins (1977) tested the response of the adults of Neochetina to a chemical (or complex of chemicals) produced by young growing tissue of the aquatic weed E.crassipes. They indicated that a significant number of weevils were attracted to this substance, which is properly termed a kiromone. They added that significantly high oviposition and feeding rates also occurred on crushed waterhyacinth tissue that released high levels of the kairomone. This kairomone appeared to cause aggregations of both N.bruchi and N.eichhorniae around fresh feeding sites, and part of the chemical complex appeared to act as a phagostimulant and an oviposition stimulant for Neochetina spp.

B. Laboratory Tests in Egypt :-

Since the project has been started, a quarantine room were equiped for introducing the weevils to be tested under quarantine conditions before any release in nature. Furthermore

Fig.11: Bathtubs used for waterhyacinth production
in the laboratory in Egypt

waterhyacinth plants were arranged to be continuously available in the laboratory for weevil feeding.

1- Waterhyacinth supply :-

In order to rear the weevils under quarantine conditions, continuous supply with fresh green waterhyacinth plants was needed. Bathtubs (Fig. 11) provided with running water were used in the laboratory for waterhyacinth production.

2- Notes on the life cycle and biology of *N.eichhornia* and *N.bruchi* :-

In May 1979, 820 adults of both species were introduced to Egypt from Fort Lauderdale, Florida to be studied and tested under quarantine conditions.

It has to be mentioned that, during the preliminary study conducted in the laboratory in Egypt, not too much differences were noticed in the biology of the two species *N.bruchi* and *N.eichhorniae*. Although the two species were separated and tested, all results given are based on considering both species as one.

Oviposition :

Forty to sixty adults of both females and males of *Neochetina* were exposed to one or two fresh green young leaves

Fig. (12): Pie-pan covered with a piece of square glass used for rearing Neochetina spp.

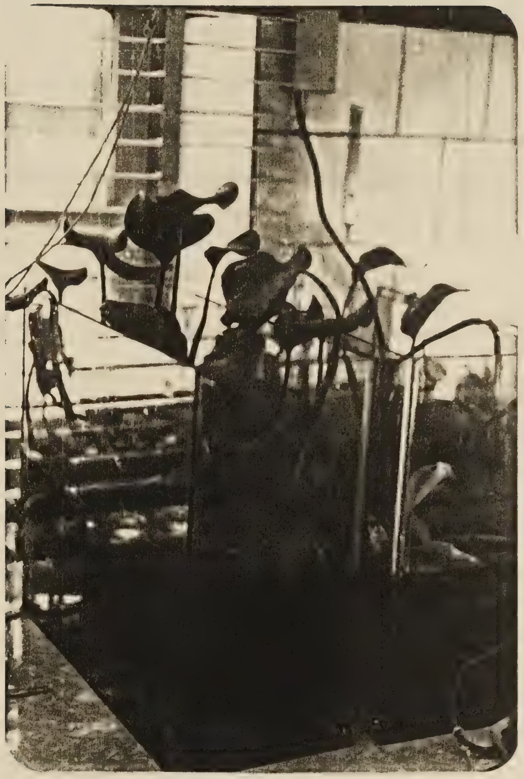


Fig. (13): Glass aquaria used for growing water-hyacinth under quarantine conditions.

and petiole desks of waterhyacinth each leaf was sucked in glass tube filled with water and fixed with a piece of cotton, put in piepan on a filter paper and covered with a piece of clear glass to keep the weevils inside for feeding and oviposition under quarantine room temperature of 23.4°C (22-29°C) and R.H. 71% (62-80%) Fig.12. The plants were replaced each 2-3 days to obtain more eggs. Another unite was used for rearing of the weevils by exposing 20-60 adults to waterhyacinth plants grown in glass aquarium measures about (50 x 40 x 20 cm) Fig. 13. The eggs were inserted individually or in groups of 2-5 eggs in the feeding adult scars and petiole. After 2-3 days, eggs were removed from the plants with pin pointed forceps. The eggs were placed on wet filter paper in petridish and examined daily for hatching or placed in artificial puncture made with forceps in petioles and covered with a piece of mask tape.

Eggs :

The eggs are whitish yellow in color, measures about 0.79 mm long, ovoid; those of N.eichhorniae are more selender and the chorion is softer (DeLoach 1975 b).

Hatching :

The eggs hatched after an incubation period of 6-10 days at an average temperature of 23.4°C and R.H. of 71%.

About 24 hours before hatching, the embryo complets its developing.The embryo is easy to be recognized through the transparent chorion with the horizontal mandible movements of the 1st instar larva while it's attempts for emergence. Time elapsed by the larva to hatch is about 18-22 hours.

Larval stages :

The newly hatched larvae were transferred from the pitridishes to waterhyacinth plants grown in glass gars or aquarium for development. The larvae were observed and examined every 2 days for measuring the rate of development. Results obtained indicated that Neochetina spp. have 3 instar larvae complete their developing to full grown larvae within about 22 days on an average temperature of 23.4°C and R.H. of 71%. The larval stage took 6, 8, 8, days for developing of first, second and third instars respectively. All larvae died after reaching the third instar and failed to pupate under quarantine conditions. More attempts had to be carried during project period.

Several shipments were expected to be recieved in Egypt for further tests under quarantine conditions and field release.

HOST SPECIFICITY TESTS :

I- MATERIALS AND METHODS :

In order to determine the host specificity and safety of Neochetina spp. to be introduced and released in Egypt in nature for control of waterhyacinth, series of feeding tests and behaviour experiments were conducted under quarantine conditions in Egypt. Only adults of both N.eichhorniae and N.bruchi were used in all the host specificity tests conducted. Three types of tests were conducted. Group plant test, paired plant test and starvation test. Advanced tests would be done on the larval stages. The list of plants tested were given in table (10).

1- Group plants test :-

In this experiment, all plants listed in table 10 were exposed together to 20 adults of N.eichhorniae (10 males and 10 females). Most of the plants were grown under laboratory conditions in small plant pots No. 10. Banana, colocasia, rice, and waterhyacinth plants were collected from the field for the test. Leaves of each plant were taken and dipped in glass tubes filled with tap water and fixed each with a piece of cotton. Plants were exposed to the adults of the weevils in a slave wooden cage with a moving glass top. Plants were replaced whenever necessary after deterioration.

Table (10): Plants of economic importance tested as food preference for adults of *Neochetina eichhorniae* and *N. bruchi* under quarantine conditions in Egypt

Ser. No.	Plants Tested: Common name	Plants Tested: Scientific name	Family
1	Banana	*Musa paradisiaca* L.	Musaceae
2	Cabbage	*Brassiea oleracea* L. var. *capitata*	Cruciferae
3	Colocasia	*Arum colocasia* L.	Araceae
4	Castor bean	*Ricinus communis* L.	Euphorbiacae
5	Cotton	*Gossypium barbadense* L.	Malvaceae
6	Horse bean	*Vicia fabae*	Leguminaceae
7	Maize	*Zea mays* L.	Gramineae
8	Rice	*Cedrus libani* Barrel	Coniferae
9	Waterhyacinth	*Eichhornia crassipes* (Mart) Solms.	Pontedriaceae

Twenty five adults of N.bruchi were tested following the same method discribed above.

Under the same conditions 20 adults (10 males and 10 females of N.eichhorniae and 25 adults (10 males and 15 females) of N.bruchi were exposed to waterhyacinth only, and 25 adults of each of the two species were confined each in glass tube without any food for control. These experiments were continued for a period of 20 days. Average quarantine temperature was 28.6°C and average relative humidity was 85.3%. Results obtained are given in tables (11,12,13).

2- Paired plant tests :

In this experiment, each of the tested plants given in table (10) with waterhyacinth Eichhornia crassipes were exposed together to Neochetina eichhorniae and N.bruchi. Paired plant test were done under quarantine conditions. Each of the tested plant was introduced to the weevils fixed in glass tube filled with water by mean of a piece of cotton. A glass tube contains waterhyacinth was exposed with each plant to the weevils in a small wooden cage of 30x30x40 cm. Five replicates were conducted for each plant. Five weevils from each species (3 females and 2 males) were used in each test. Plants were replaced 3 times during the duration of the test which continued for a period of 10 days. Quarantine temperature ranged between a minimum of 18°C and a maximum of

31.5°C with an average of 29.2°C during the experimental period. Relative humidity varied from a minimum of 40% to a maximum of 91.5% with an average of 85.7% during the experimental period. Number of feeding spots and deposited eggs in each case are indicated in tables (14, 15). During the paired plant tests, it was observed that two replicates out of five in the case of banana (*Musa paradisiaca*) showed no feeding spots on banana leaves. It was suggested that the age of banana leaves may affect the feeding preference of the adults of *Neochetina*. Accordingly, an experiment was conducted using different stages of banana leaves introduced to the adult weevils of both species of *Neochetina*. Ten replicates of five adults each were tested. Number of feeding spots was counted dailly and continued for a period of 6 days. Results obtained are given in table (16).

3- Starvation tests :

Staravation tests were conducted under quarantine conditions. All plants mentioned in table 10 were used in this test. Adults of both *N.eichhorniae* and *N.bruchi* were kept without any food for a period of three days before introducing any of the tested plants. Each plant was dipped in a glass tube of 7.5 cm in diameter. filled with water. Plants were fixed in the tube with a piece of cotton. A filter paper of 9.5 cm in diameter, was placed in the bottom of the plate. Drops of distilled water were poured into the

plate to provide high humidity to the insects and prevent fast drying of the plants. Each plant was exposed individually in plate covered with glass square to 5 starved adult weevils. Five replicates were conducted for each plant. Plants were replaced whenever necessary after deterioration. Adults tested were collected from Florida and introduced to Egypt under quarantine conditions in April 1979. The test was continued until death of the weevils. Rate of mortality was determined every 3 days. Results obtained are given in tables 17 and 18.

RESULTS AND DISCUSSION

Testing of insects for host specificity is the most important part of studying the safty of these insects to be introduced to a new country to serve as biological control agent. *Neochetina eichhorniae* and *N.bruchi* are native insects in South America. These weevils have never been recorded as a pest of any cultivated or economic crop. Perkins and Maddox (1976), indicated that the genus *Neochetina* is closely tied to plants of family Pontederiaceae, and the three known species in this genus being recorded only from *Eichhorniae* and *Pontederia.* The most famous species which are known to be occurred under the genus *Eichhornia*, are *E.crassipes* (Mart.) Solms and *E.azurea* (SW.) Kunth. Only one species *Pontederia cordata* L. is known under the second genus. All of these species are aquatic plants (Baiely 1969). The tribe

Table 11:- Plants group host specificity tests for aduls of *N. eichhorniae* and *N. bruchi* under quarantine conditions in Egypt. 28.6^{o}c.and 85.3% R. H .

Plants tested	No.of Leaves offered during the experiment		Aver. No. of feeding spots per leaf		Aver. No. of feeding spots per day		Aver. No. of eggs deposited per leaf		Aver. No. of eggs deposited per day.	
	N.eich-horniae	*N.bru-chi*	*N.eich-horniae*	*N.br-uchi*	*N.eich-horniae*	*N.br uchi*	*N.eich-horniae*	*N.br uchi*	*N.eich-horniae*	*N.bru chi*
Banana	8	10	210.0	180.0	105.0	98.2	0	0	0	0
Cabbage	3	3	0	0	0	0	0	0	0	0
Calocasia	3	3	0	0	0	0	0	0	0	0
Castor bean	7	7	0	0	0	0	0	0	0	0
Cotton	5	5	0	0	0	0	0	0	0	0
Horse bean	7	6	0	0	0	0	0	0	0	0
Maiza	4	5	0	0	0	0	0	0	0	0
Rice	5	5	0	0	0	0	0	0	0	0
Water-hyacinth	6	8	202.5	178.0	81.0	90.5	53.3	43.2	16.0	12.0

Table (12) Longevity of adults of <u>N. eichhorniae</u> and <u>N. bruchi</u> when kept under quarantine condition without providing any food .

(Aver . temp. 28.6° c and R. H . 85.3%)

Species of insects	Mortality of adults % on successive days																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
N. eichhorniae	0	0	4	0	0	12	0	32	52	-	-	-	-	-	-	-	-	-	-	-
N. bruchi	0	0	0	8	4	0	0	32	8	8	40	-	-	-	-	-	-	-	-	-

Table (13) : Longevity of adults and number of eggs laid when adults of _N. eichhorniae_ and _N. bruchi_ fed on water hyacinth only under quarantine conditions

(Aver. temp . 28.6 °c. and R. H. 85 . 3 %)

Species of insects	Aver.no.of eggs laid per adult female	Mortality of adults % on successive days																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
N. eichhorniae	32.0	0	0	0	0	5	0	0	0	0	15	0	0	0	0	0	0	5	0	0	0
N. bruchi	25.2	0	0	0	0	0	16	0	0	4	0	0	0	8	0	0	0	0	0	4	4

Table (14) :- Amount of feeding spots and No.of eggs deposited by adults *Neochetina eichhorniae* exposed to different plants paired with *Eichhornia crassipes* under quarantine conditions. (Aver. temp. 29.2°C . and Aver. R. H. 85.7%

Species of test plant	Total NO. of feeding spots. (in 10 days period)		Total No. of eggs deposited (in 10 days period)	
	E. crassipes	Test plant	*E. crassipes*	Test plant
Musa poradisiaca L.	87	62	180	0
Brassica oleracea L. ver. *capitata*	275	0	210	0
Arum colocasia L .	266	0	186	0
Ricinus communis L.	276	0	190	0
Gossypium communis L.	190	0	198	0
Vicia fabae	301	0	206	0
Zea mays L .	280	0	198	0
Cedrus libani Barrel	293	0	200	0

Table (15):- Amount of feeding spots and eggs deposited by adults *Neochetine bruchi* exposed to different plants paired with *Eichhornia crassipes* under quarantine conditions. (Aver. temp.29 .2°c and aver. R.H. 85.7%).

Species of test plant	Total No. of feeding spots. (10 days period)		Total No. of eggs deposited (10 days period)	
	E. crassipes	Test plant	*E. crassipes*	Test plant
Musa paradisiaca L.	55	45	165	0
Brassiea oleraces L. var. *capitata*	168	0	181	0
Arum colocasia L.	201	0	149	0
Ricinus communis L.	208	0	133	0
Gossypium barbadense L.	160	0	145	0
Vicia fabae	182	0	138	0
Zea mays	131	0	166	0
Cedrus libani	179	0	169	0

Table (16) Number of feeding spots by adults of Neochetina spp on different stages of banana leaves under quarantine condition

Species of adults	Total number of feeding spots during the expermintal period									
	Riplicate numbers									
	1	2	3	4	5	6	7	8	9	10
N. eichhorniae	138	122	0	131	0	0	0	0	123	0
N. bruchi	129	0	0	111	0	89	0	0	0	0

Table 17 :- Feeding, oviposition and mortality of N. eichhorniae in starvation tests conducted under quarantine conditions in Egypt.

(Aver. Temp. 28.1^{o}c - Aver. R. H. 87.8%)

Plant spp.	No.of feeding spots	No.of deposited eggs	Mortality of adults% on plant species evry successive three days period														
			3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
Musa paradisiaca *	980	0	4	0	4	12	64	8	8	-	-	-	-	-	-	-	-
Brassiea oleracea var. capitata	0	0	20	16	64	-	-	-	-	-	-	-	-	-	-	-	-
Arum colocasia	0	0	12	20	48	20	-	-	-	-	-	-	-	-	-	-	-
Ricinus communis	0	0	36	20	8	8	40	-	-	-	-	-	-	-	-	-	-
Gossypium barbadense	0	0	20	4	40	36	-	-	-	-	-	-	-	-	-	-	-
Vicia fabae	0	0	4	12	32	36	16	-	-	-	-	-	-	-	-	-	-
Zea mays	0	0	48	36	16	-	-	-	-	-	-	-	-	-	-	-	-
Cedrus libani	0	0	24	48	28	-	-	-	-	-	-	-	-	-	-	-	-
Eichhornia crassipes	4580	420	0	4	0	0	4	0	8	4	0	0	0	0	16	0	4

* All banana leaves used were young growing fresh leaves.

Table 18: Feeding, oviposition and mortality of _N. bruchi_ in starvation tests conducted under quarantine conditions in Egypt

(Aver. temp. 28.1^{o}c - Aver. R.H. 87.8%)

Plant spp.	No.of feeding spots	No.of deposited eggs	Mortality of adults % on plant species every successive three days period														
			3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
Musa paradisiaca L. *	1020	0	8	12	0	8	24	12	32	4	-	-	-	-	-	-	-
Brassiea oleracea L. var. _capitata_	0	0	36	16	8	16	24	-	-	-	-	-	-	-	-	-	-
Arum colocasia	0	0	40	36	24	-	-	-	-	-	-	-	-	-	-	-	-
Ricinus communis L.	0	0	48	24	28	-	-	-	-	-	-	-	-	-	-	-	-
Gossypium barbadense L.	0	0	44	40	0	0	16	-	-	-	-	-	-	-	-	-	-
Vicia fabae	0	0	24	8	48	20	-	-	-	-	-	-	-	-	-	-	-
Zea mays L .	0	0	52	32	16	-	-	-	-	-	-	-	-	-	-	-	-
Cedrus libani Barrel	0	0	60	12	0	28	-	-	-	-	-	-	-	-	-	-	-
Eichhornia crassipes (Mart) Solms.	3938	388	12	0	0	0	0	8	0	0	0	4	4	0	0	0	4

* All banana leaves used were young growing fresh leaves

Bagoini, to which <u>Neochetina</u> belongs is limited to an aquatic environment . The life cycle of both species of <u>Neochtina</u> can be completed only on waterhyacinth due to the unique underwater pupation site in the roots of this plant. Plants and crops of economic importance from Egyptian view are considered to be tested in this study.

<u>Group plant tests</u> :-

Out of 9 economic plants including waterhyacinth tested under quarantine conditions in Egypt for both species of the weevils, only 2 species were fed upon, (table 11). These plants were banana and waterhyacinth. In all other tested plants no feeding spots or attempts were observed. On the other hand both <u>N.eichhorniae</u> and <u>N.bruchi</u> laid eggs on waterhyacinth only. In general, average number of feeding spots caused by <u>N.eichhornia</u> slightly exceeds the average of feeding spots caused by <u>N.bruchi</u>. It has to be mentioned that, the average number of feeding spots counted on banana leaves were slightly higher than on the water-hyacinth. It was observed that adults of both species fed only on the young fresh growing banana leaves and not on the old leaves Adults of both <u>N.eichhornia</u> and <u>N.bruchi</u> collected from the field did not survive more than 11 days without food table (12). The majority of adults fed on waterhyacinth survived for more than the 20 days of the experiment. Average number of eggs laid by <u>N.eichhornia</u> was 32.0 eggs per adult femal during the duration

of the experiment whereas the average number of eggs laid by N.bruchi were 25.2 per female during the same period (table 13). It is to be concluded that the adults of N. eichhorniae and N.bruchi fed only on waterhyacinth and young banana leaves when they were exposed to all the tested plants together. Adult females of both species laid eggs only on waterhyacinth and not on any other plant tested (table 14).

Paired plant tests :-

In the paired plant tests (Tables 14, 15), besides waterhyacinth, only banana (Musa paradisiaca) was fed upon. The number of feeding spots counted on young fresh banana leaves slightly exceeds the number counted on waterhyacinth. In all cases, no eggs laid and no feeding spots occurred on any plants other than waterhyacinth. Old banana leaves tested as a host showed non preferable to both species of the weevils since no feeding spots have been occured. This result indicates that adults of Neochetina may feed upon banana leaves when offered as young fresh leaves only without laying eggs. It was observed during the paired plant tests that species of plant tested with waterhyacinth affects the amount of waterhyacinth consumed since it was found that the number of feeding occured upon waterhyacinth varies in each test.

<u>Starvation tests</u> :-

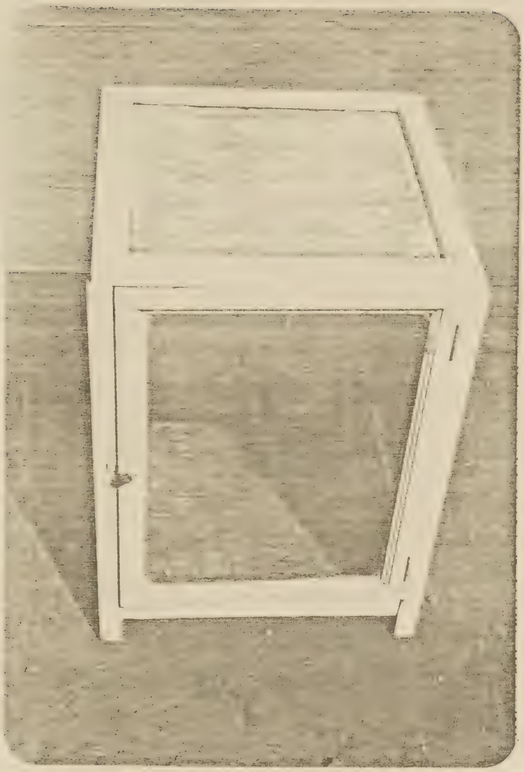
This test is considered the most important test. If the weevils starved to death rather than feed on the plant species, safety to this plant under less restrictive conditions for the weevil was assured. The results shown in tables 17 and 18 indicated that during the no choice plant test, feeding spots occured only on waterhyacinth and young fresh banana leaves. Adult females laid their eggs only in waterhyacinth tissues. Number of feeding spots were higher on waterhyacinth than occured on the young fresh banana leaves. Feeding spots caused by <u>N.eichhorniae</u> adults were 4580 and 980 feeding spots on <u>E.crassipes</u> and <u>M.paradisiaca</u> respectively. Feeding spots caused by <u>N.bruchi</u> adults were 3938 and 1020 feeding spots on <u>E.crassipes</u> and <u>M.paradisiaca</u> respectively. It is indicated that the total amount of waterhyacinth consumed by <u>N.eichhorniae</u> or <u>N.bruchi</u> were higher than the amount of banna leaves consumed.

In general in all host specificity tests, it is proved that <u>N.eichhorniae</u> consume an amount of waterhyacinth more than it may be consumed by <u>N.bruchi</u>. No eggs laid by adult female of both <u>Neochetina</u> species on any of the tested plants other than waterhyacinth. Number of eggs laid by females of <u>N.eichhorniae</u> was slightly higher in numbers than it was laid by femalesof <u>N.bruchi</u>. Both species of <u>Neochetina</u> survived for a period exceeded the duration of the test

which lasted 45 days when fed on waterhyacinth only. Adults of N.eichhorniae and N.bruchi survived for a maximum period of 21 and 24 days respectively when exposed to young fresh banana leaves only. N.eichhorniae survived for the maximum periods of 9,10,15,[illegible] and [illegible] on cabbage, colocasia, castor been, cotton, horse bean, maize and rice respectively. N.bruchi survived for the maximum periods of 15,9,9,15,12,9 and 12 days on cabbage, colocasia, castor bean, cotton, horse bean, maize and rice respectively. In general conclusion, the damage occured on fresh green young banana leaves has been considered negligible since the adults of both species feeds only on the young leaves and not the mature old ones. On the other hand the adult females did not deposit any eggs on banana plants even the young leaves. Since the genus Neochetina is closely tied only to plants of the family Pontederiaceae, and the life cycle of the weevils can be completed only in pupation site under water, the safety of the weevils N.eichhorniae and N.bruchi as biological control agent of waterhyacinth has been proved. The studies, conducted in Argantina, Austeralia, U.S.A., Egypt and several other counteries support the safety of these insects to serve as biocontrol agent without any possibility to affect or cause any damage to any plants other than plants of the family Pontederiaceae. More host plants would be tested before final decision could be made.

Table (19) : LIST OF PLANTS TESTED FOR HOST SPECIFICITY OF *N. eichhorniae*

Ser. No.	Plants tested		Family
	Common name	Scientific name	
1	Banana	*Musa paradisiaca* L.	Musaceae
2	Lettuce	*Lactuca sativa* L.	Compositae
3	Indian shot, flowering reed	*Canna indica* L.	Cannaceae
4	Onion	*Allium cepa* L.	Liliaceae
5	Spinach	*Spinacia oleracea* L.	Chenopodiaceae
6	Suger-beet	*Bita vulgaris* var. *folloisa*	"
7	Vegetable beet	*B.valgaris* var. *rapae*	"
8	Waterhyacinth	*Eichhornia crassipes*	Pontederiaceae
9	Wheat	*Triticum vulgare* Vill	Gramineae



A.

B.

Fig. (14): Different cages used in the host specificity tests under quarantine conditions.
A- Wooden glass door cage 47 cmx47 cm x 66 cm.
B- Wooden wire screen cage 84 cmx 63 cm x 32 cm.

II- MATERIALS AND METHODS :

During a next period of this project, a series of host specificity tests were conducted under quarantine conditions to complete the study. Both adults and larvae of N.eichhorniae were used for the tests. Three types of tests were conducted. These were group plants tests, paired plants tests and starvation tests. The same procedure described before was followed. The list of plants tested was given in Table (19):-

A. GROUP PLANTS TESTS :

All plants listed in table (19) were exposed simultaneously to 25 adults of N.eichhorniae (15 males and 10 females) in wooden glass door cage (47 cm. x 47 cm. x 66 cm.) with muslin cloth sides, or in wooden wire screen cage (84 cm. x 63 cm. x 32 cm.) (Fig. 14 A&B). Lettuce, onion, spinach, sugar-beet, vegetable beet and wheat were grown under natural conditions in small plant pots No. 10 in the laboratory. Banana and indian shot were collected from the field for the tests and waterhyacinth from laboratory rearing. Fresh young green leaves of each plant were choosen, dipped in glass tubes filled with tap water and fixed with a piece of cotton. Plants were replaced whenever necessary after deterioration. Results obtained are given in table (20).

Under the same conditions, 15 adults (10 females and 5 males) of N.eichhorniae were exposed to waterhyacinth only. Plants were replaced each 3 days and the numbers of feeding spots and deposited eggs were counted. On the other hand, 20

TABLE 20: AMOUNT OF FEEDING SPOTS AND NUMBER OF EGGS DEPOSITED BY *N. EICHHORNIAE* ADULTS WHEN EXPOSED SIMULTANEOUSLY TO DIFFERENT HOST PLANTS IN THE GROUP PLANTS TEST. (Aver. temp. 29.2°C , Aver. R.H. 89.2%)

Ser. No.	Tested Plants	Feeding Spots		Eggs deposited		Aver. NO of feeding spots per adult	Aver No. of eggs depoited per female
		No.	% of the total	No.	% of the total		
	Banana	123	5.26	4	1.81	4.92	0.4
	Lettuce	9	0.38	0	0	0.36	0
	Indian shot	89	3.80	3	1.36	3.56	0.3
	Onion	0	0	0	0	0	0
	Spinach	0	0	0	0	0	0
	Suger beet	0	0	0	0	0	0
	Vegetable-beet	0	0	0	0	0	0
	Waterhyacinth	2116	90.5	213	96.81	84.64	21.3
	Wheat	0	0	0	0	0	0
	Total	2337		220			

adults (7 females and 13 males) were confined each in a glass tube without providing any food for control. These experiments were continued for a period of 23 days. Average quarantine room temperature was 29.2°C with a minimum of 18°C and a maximum of 32°C, and the average relative humidity was 89.2% with a minimum of 61% and a maximum of 92.5%. Results obtained are given in table (21 and 22).

B. PAIRED PLANTS TESTS :

In these experiments, each of the plants listed in table (19) was exposed in combination with waterhyacinth to 5 adults (2 females and 3 males) of *N.eichhorniae*. Adults were confined with the plants in pie pan covered with a piece of clear square glass (24 cm. x 24 cm.) to keep the weevils inside. A filter paper of 12 cm in diameter was placed in the bottom of the pan and disteled water was provided to raise the humidity. Five replicates were conducted for each plant. Plants were replaced each 2-3 days during the duration of the test which continued for a period of 13 days. Number of feeding spots and number of deposited eggs were counted every 2 days. The test was conducted under quarantine conditions of an average temperature of 28.9°C (minimum of 17.5°C and a maximum of 31.5°C) and average relative humidity of 84.2% (minimum 42% and maximum of 90%). Results obtained are given in table (23).

C. STARVATION TESTS :

During the reporting period, under quarantine conditions, adults of N.eichhorniae collected from Brisbane, Austrelia were used for the test. Plants listed in table (19) were exposed individually to the weevils after 7 days starvation. Each plant was dipped in glass tube of 7.5 long filled with tap water and fixed with a piece of cotton. Glass tubes were placed on a filter paper of 9.5 cm. in diameter placed in the bottom of a pan plat. Drops of distilled water were poured in each plate to provide high humidity for the insects and to prevent fast drying of the plants. Plants were replaced whenever necessary after deterioration. Each plate was covered with a glass square to keep the weevils inside. Seven starved adults (3 females and 4 males) were confined with each plant. Five replicates were conducted. Rate of mortality was determined every 3 days. The test was continued until the death of the weevils. Average temperature recorded during the test was 28.5°C and average relative humidity was 85.5%. Results obtained are given in table (24).

D. LARVAL TESTS :

Under the same conditions, only plants seemed to be attacked by the weevils including waterhyacinth were considered in the test. These plants were: banana, indian

TABLE 1 :AMOUNT OF FEEDING SPOTS AND NUMBER OF EGGS DEPOSITED BY ADULTS OF N. EICHHORNIAE (10 females + 5 males) WHEN EXPOSED TO WATERHYACINTH ONLY (Aver. temp. 29.2°C, aver. R.H. 89.2%)

Examining periods (days)	No.of feeding spots	Averg.No.of feeding spots per adult	No.of deposited eggs	Averg.No.of eggs deposited per female
3	53	3.53	0	0
6	182	12.1	6	1.2
9	201	13.4	11	2.2
12	152	10.1	7	1.4
15	89	5.9	9	1.8
18	209	13.9	9	1.8
21	198	13.2	2	0.4
23	183	12.2	7	1.4
Total	1267	84.46	51	10.2
Aver. Daily No.	55.08	3.67	2.2	0.44

Table (22) SURVIVAL OF STARVED ADULTS OF N.EICHHORNIAE KEPT IN GLASS TUBES UNDER QUARANTINE CONDITIONS

(Aver. temp 29.2^{o}c aver R.H. 89.2 %)

Weevils sex	No. of adults survived untill the end of the test	Mortality of starved adults % on successive days																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Males	0	0	0	0	0	0	0	0	0	5	0	10	0	0	15	5	0	0	10	0	5	15	-	-
Females	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	10	5	0	0	0	0

TABLE [illegible]: AMOUNT OF FEEDING SPOTS AND NUMBER OF EGGS DEPOSITED BY ADULTS OF N. EICHHORNIAE EXPOSED TO DIFFERENT PLANTS PAIRED WITH WATERHYACINTH UNDER QUARANTINE CONDITIONS (Aver.temp 28.9^{o}c and Aver.R.H. 84.2% .)

Species of tested plants	Total No. of feeding spots (in 13 days period)		Total No. of eggs deposited (in 13 days period)	
	Waterhyacinth	Tested plant	Waterhyacinth	Tested plant
Musa paradisiaca L.	632	213	315	0
Lactuca sativa L .	879	12	122	0
Canna indica L.	430	415	381	4
Allium cepa L.	528	0	98	0
Spinacia oleracea L.	1002	0	316	0
Bita vulgaris var. folloisa	928	0	298	0
B.v.var. rapae	982	0	324	0
Triticum vulgare	1426	0	253	0

TABLE 4 FEEDING,OVIPOSITION AND MORTALITY OF ADULTS OF N.EICHHORNIAE IN THE STARVATION TESTS CONDUCTED UNDER QUARANTINE CONDITIONS IN EGYPT. (Aver.Temp. 28.5^{o}C and Aver R.H. 85.5%)

Species of tested plants	No. of adults survived untill the end of the test		Percentage of the total%	No.of feeding spots	No.of deposited eggs	Mortality of adults % on different plant species every successive three days period																	
						3	6	9	12	15	18	21	24	27	3o	33	36	39	42	45	48	51	54
Musa paradisiaca	2	4	17.1	1617	18	0	0	0	5.7	0	0	2.8	0	22.8	8.6	0	11.4	0	5.7	14.2	11.4	0	0
Lactuca sativa	3	10	37.1	72	2	2.8	0	0	0	8.6	0	5.7	12.8	0	8.6	2.8	2.8	14.3	0	8.6	5.7	0	2.8
Canna indica	4	6	28.6	582	6	0	0	0	0	0	8.6	0	17.1	5.7	0	0	20	5.7	0	0	11.4	2.8	0
Allium cepa	0	0	0	0	0	2.8	0	14.3	2.8	0	8.6	20	0	34.3	8.6	0	0	2.8	5.7	-	-	-	-
Spinacia oleracea	0	0	0	0	0	8.6	2.8	5.7	14.3	20	0	0	25.7	0	11.4	2.8	8.6	-	-	-	-	-	-
Bita vulgaris var. folloisa	0	0	0	0	0	0	0	14.3	8.6	0	20	0	2.8	17.1	0	37.1	-	-	-	-	-	-	-

Table 24: (cont.)

Species of tested plants	No. of adults survived until the end of the test		Percentage of the total%	No. of feeding spots	No. of deposited eggs	Mortality of adults % on different plant species every successive three days period																
						3	6	9	12	15	18	21	24	27	3o	33	36	39	42	45	48	51
B.v.var. rapae	0	0	0	0	0	0	0	0	2.8	14.3	2.8	25.7	34.3	0	0	17.1	0	0	0	0	2.8	-
Triticum vulgare	0	0	0	0	0	22.8	0	45.7	0	0	31.4	-	-	-	-	-	-	-	-	-	-	-
Eichhornia crassipes	19	14	94.3	12852	1863	0	0	0	0	0	0	0	2.8	0	0	0	0	0	0	0	2.8	0
TOTAL	28	34		15123	1889																	

shot, lettuce, and waterhyacinth. Artificial punctures were made in the leaves or the petioles of each of the four plants tested. Ten newly hatched larvae or mature deposited eggs just before hatching were transfered from infested waterhyacinth plants to each of the four tested plants. Punctures were covered with a thin layer of parafine wax after introducing the larvae to prevent secondary infections. Plants were dissected 10 days after, and survival on the plants were recorded. On the other hand 10 newly hatched larvae were kept without dissection in waterhyacinth plants placed in glass aquarium. Soil was placed at the bottom of the aquarium for insects pupation. Plants were observed for adults emmergence. Results obtained are given in table (25).

TABLE25: SURVIVAL AND DVELOPMENT OF THE LARVAE OF N. EICHHORNIAE ON CERTAIN HOST PLANTS INCLUDING WATERHYACINTH

Ser. No.	Plants tested	No.of survived larvae	No.of adults emerged
1	*Musa paradisiaca*	0	0
2	*Lactuca sativa*	0	0
3	*Canna indica*	0	0
4	*Eichhornia crassipes*	7	2

RESULTS :

A. GROUP PLANTS TESTS :

During this experiment, 9 plants including waterhyacinth were considered for the tests. In addition to waterhyacinth, only 3 plants were found to be slightly fed upon. These plants are : banana, lettuce, and indian shot (table 20). During the period of the test which extended to 23 days, banana had 123 feeding spots representing 5.26% of the total. Lettuce had only 9 feeding spots representing 0.38% of the total. Indian shot had 89 feeding spots representing 3.8% of the total. Whereas waterhyacinth had 2116 feeding spots representing 90.5% of the total. No feeding spots were observed on onion, spinach, sugar beet, vegetable beet or wheat. Numbers of feeding spots per adult avereged 4.92, 0.36, 3.56 and 84.6 on banana, lettuce, indian shot and waterhyacinth respectively. On the other hand, in addition to waterhyacinth very few eggs were deposited on 2 plants only of the tested hosts. Four eggs representing 1.8% of the total were found on banana leaves and 3 eggs only representing 1.36% were found on indian shot leaves. Whereas a total of 213 eggs representing 96.8% of the total were counted on waterhyacinth alone.

When adults of N.eichhorniae were exposed under the same conditions to waterhyacinth alone, (table 21) they

started to feed immediately but no eggs were deposited before the third day since it is known that the weevils prefer to oviposit in the previous feeding spots and old wounds. Average number of feeding spots per adult ranged between a minimum of 3.53 and a maximum of 13.9 with a total average of 84.46 eggs per adult during the duration of 23 days of the experiment. The average daily number of feeding spots based on 15 adults was 55.08 feeding spots with an average of 3.67 feeding spots per adult per day.

The total number of eggs laid by the five females of N.eichhorniae was 51 eggs within a period of 23 days with an average daily number of 2.2 eggs per day. Each female deposited an average of 10.2 eggs during the duration of the test with an average daily number of 0.44 per female. Starved adult females survived a period of about 2 weeks without any percentage of death. Five percent mortality occurred after 15 days. At the end of the test (23 days) only 3 adult females representing 15% of the total adults tested, were still alive. All males tested were died after three weeks (table 22).

B. PAIRED PLANTS TESTS :

Insects applied to different host plants paired with waterhyacinth showed highly preference in both feeding and ovipositing behaviours to waterhyacinth. Adults of N.eichhorniae showed slight feeding spots on each of banana,lettuce

and Indian shot. The great number of feeding spots were counted on waterhyacinth. When the adults confined with banana and waterhyacinth in combination with each other, they fed on both plants. The number of feeding spots counted were 632 and 213 with a ratio of about 3:1 on waterhyacinth and banana respectively. The number of feeding spots caused by the weevils when confined with lettuce and waterhyacinth were 879 and 12 representing a ratio of 73.2:1 on waterhyacinth and lettuce respectively. The number of feeding spots occurred on both host plants; indian shot and waterhyacinth when confined together with the adults of N.eichhorniae were 430 and 415 representing a ratio of 1.03:1 on waterhyacinth and indian shot respectively. No feeding spots were observed on onion, vegetable beet, sugar beet, spinach and wheat. The highest number of feeding spots (1426) occurred on waterhyacinth when paired with wheat. On the other hand, no eggs were deposited on any of the tested plants other than waterhyacinth with the only exception of 4 eggs found on the indian shot. The lowest number of eggs deposited was on waterhyacinth paired with onion and the highest number of eggs was found on waterhyacinth paired with indian shot.

C. STARVATION TESTES :

In this test a total of 25 adults in 5 replicates were exposed to each of the tested host plants listed in table

(19). Feeding spots were observed on each of banana, lettuce and indian shot in addition to waterhyacinth. Numbers of feeding spots occurred were 1617, 72, 582, and 12852 representing 10.7%, 0.47%, 3.84% and 84.98% of the total of 15123 feeding spots counted on banana, lettuce, indian shot and waterhyacinth respectively. Eggs deposited on different hosts were 18 on banana, 2 on lettuce, 6 on indian shot and 1863 on waterhyacinth representing 0.95%, 0.1%, 0.31% and 98.62% of the total of 1889 eggs on the corresponding plants. No eggs were deposited on onion, spinach, sugar beet, vegetable beet or wheat. Numbers of adults survived until the end of the test on each plant were 6, 13, 10 and 33 adults on banana, lettuce, indian shot and waterhyacinth respectively representing 17.1%, 37.1%, 28.6% and 94.3% of the adults on the corresponding plants. Mortality of 100% occurred on onion after 42 days, on spinach after 36 days, on sugar beet after 33 days, on vegetable beet after 48 days, and on wheat after 5 weeks (table 24).

D. LARVAL TESTS :

Only four plants which showed to be attacked by the adults were considered in the larval tests. Results obtained (table 25) indicated that all eggs transfered to the different plants considered in the test, hatched normaly.

Hundered percent mortality occurred in the larvae during the first instar larvae on each of banana,lettuce, and indian shot after 10 days. Number of survived larvae occu-rred on waterhyacinth was 7 larvae almost in the first stadium. Out of 10 larvae transfered to waterhyacinth and kept without dissection for adults emergence, only 2 adults emerged after a period of 53 days.

DISCUSSION AND CONCLUSIONS :

During this experiment, certain new host plants were considered for host specificity tests. These plants were tested for the possibility of attacking by the weevils when released in nature for control of waterhyacinth. Furthermore, plants previousely slightly attacked by the adults were tested by artificial larval attack to ensure the probability of the weevils to develop upon. Results obtained from both feeding or starvation tests serve to indicate the maximum condition in which the insects may be exist in nature. Thus, safety of introducing the weevils in Egypt could be ascertain. The number of feeding spots, survival and the number of eggs deposited on certain plants other than waterhyacinth indicated that damage would be negligible outside the main host *Eichhornia creassipes*. The slight damage occurred which did not exceed 5.26% on banana, 3.8% on indian shot, 0.38% on lettuce and accidentally the very few number of eggs deposited 0.4[illegible] on

banana, 0.3% on indian shot in the group plant tests that more closely stimulated field conditions were negligible in comparision with the number of feeding spots and eggs deposited on waterhyacinth.

When waterhyacinth paired with the tested plants (table 23), results obtained indicated that there is a highly significant preference for the weevils to feed and oviposit on waterhyacinth. Damage occurred on banana and lettuce was negligible compared with damage to waterhyacinth.

Although the damage occurred on indian shot leaves was relatively high compared with damage to waterhyacinth, only 4 eggs deposited on indian shot while 381 eggs deposited on waterhyacinth. However, these plants lack the underwater roots required Neochetina spp. for pupation. Furthermore Canna is not considered an economic crop in Egypt. To the best of our knowledge, family Pontedriaceae is represented only by waterhyacinth in Egypt. Zwolfer and Harris (1971), indicated that the question of whether an insect can develop on a plant species not just feed on it, should the criterion for judging the safety of an insect before introduction. During the starvation tests (table 25), the percentage of 94.3% survival of N.eichhorniae on waterhyacinth occurred at the end of the experiment (54 days), whereas high percentage of mortality occurred on plants other than waterhyacinth within a period of 3 weeks. Life

cycle could not be completed on any of the tested plants other than waterhyacinth.

In general conclusion, the genus Neochetina is closely tied only to plants of the family Pontedriacae in which waterhyacinth is the only species known to be occurred in Egypt. Immature forms did not survive or develop on any host plant other than waterhyacinth. Larvae developed, and adults emerged only from waterhyacinth. The fact that the life cycle of the weevils could be completed only by pupation in cocoons under water provids the safity of N.eichhorniae and N.bruchi to be introduced and released in Egypt for biological control of waterhyacinth since it has been proved that the weevils did not affect rice which is considered the most economic plant grown in water in Egypt.

It is recommended that, approval for releasing the weevils in nature in Egypt for biological control of water-hyacinth has to be granted.

III- MATERIALS AND METHODS :-

During this experiment, certain plants were suggested to be tested for host specificity of Neochetina spp. The plants were chosen based on their aquatic habitat and economic historical importance as ancient Egyptian plants. Only adults of both Neochetina eichhorniae and N.bruchi were tested. Group plants test, paired plants test and starvation test were conducted. The same procedure described in previous experiments were followed. List of the plants tested is given in Table (26).

Table (26): List of plants tested for the host specificity of Neochetina spp. during the period July,1981-June,1982 under quarantine conditions in Egypt.

Ser. no.	Plants tested		Family
	Common name	Scientific name	
1-	Bardy	Cyperus papyrus	Cyperaceae
2-	Bashneen	Nymphaea coerulea Sav.	Nymphaeaceae
3-	Lotus	N.lotus L.var.aegyptia Tuzs.	"
4-	Samaar	Cyperus alopecriodes	Cyperaceae
5-	Water-hyacinth	Eichhornia crassipes	Pontederiaceae

A- <u>Group plants tests</u> :

All plants listed in Table (26), were exposed simultaneously to 10 adults of *N.eichhorniae* (5 males and 5 females) in different cages described in the previous reports. Three replicates were conducted. All plants exposed were collected from the nature with the only exception of waterhyacinth which was grown in the laboratory. Pieces from either stalks or leaves of the tested plants were exposed. Plants were replaced after deterioration or whenever necessary. The test was conducted under quarantine conditions of 29.9°C and 76.8% R.H. and 16 h artificial light. Feeding attempts were observed daily and number of feeding spots and eggs deposited were counted every 3 days. Results obtained are given in Table (27). Under the same conditions, 5 adults; (3 females and 2 males) of *N.bruchi* were exposed to the same plants simultaneously. Plants were examined for number of feeding spots and dissected for number of eggs deposited. The experiments were continued for a period of 2 weeks. Three replicates were conducted. Results obtained were given in Table (28).

B- <u>Paired plants tests</u> :

Each plant of the list given in table (26) was exposed in-combination with waterhyacinth to 5 adults

(2 males and 3 females) of _N.eichhorniae_ following the same procedure described before. Number of feeding spots and eggs deposited were counted daily. The tests were conducted under aver. quarantine temp. of 28.9°C and 80.2% R.H. and 16 h. light. Three replicates were conducted. Results obtained are given in Table (29).

Under the same conditions 3 adults (2 females and 1 male) of _N.bruchi_ were exposed to waterhyacinth combined with each of the plants listed in Table (26). Number of feeding spots and eggs deposited on each plant were counted. The test was continued for a period of 10 days. Results obtained are given in Table (30).

C- Starvation tests :-

Weevils of both _N.eichhorniae_ and _N.bruchi_ were kept under quarantine conditions without providing any food for a period of 7 days. After which, plants listed in table (26) were exposed individually to the starved weevils. Five adults (2 females and 3 males) from each of the two species were exposed. Three replicates were conducted for each species. Number of feeding spots, eggs deposited and survival of adults were determined. The test was continued until the death of the weevils. Results obtained are given in Tables (31 & 32).

Under the same conditions 15 starved adults from each of the two species; *N.eichhorniae* and *N.bruchi* were kept under quarantine conditions without providing any food during the duration of the test which continued untill the death of the adults, for control. Results obtained are given in Table (33).

RESULTS :

A- Group plants tests :-

No feeding spots occurred or eggs deposited on any of the plants tested except on the target aquatic weed; waterhyacinth when exposed simultaneously to both adults of N.eichhorniae and N.bruchi under quarantine conditions (Tables 27 & 28).

During the period of the test which extended for a period of 14 days, only waterhyacinth had 2982 and 1218 feeding spots caused by 15 and 30 adults of N.eichhorniae and N.bruchi, respectively. These numbers represented 100% of the total numbers of feeding spots counted on all tested plants. The average numbers of feeding spots per adult per day were 7.1 and 5.8 feeding spots for N.eichhorniae and N.bruchi, respectively. On the other hand, no eggs were found on any of the plants other than waterhyacinth. The number of eggs deposited on waterhyacinth were 336 and 139 eggs laid by 15 and 9 females of N.eichhorniae and N.bruchi, respectively. The average numbers of eggs deposited per female per day were 1.6 and 1.1 eggs laid by females of N.eichhorniae and N.bruchi, respectively.

It is to be mentioned that, generally the size of

Table (27): Number of feeding spots and eggs deposited on different plants when exposed simultaneously to the adults of *N.eichhorniae* under quarantine conditions.
(29.9°C and 76.8% R.H.)

Ser no.	Tested plants	Feeding spots		Eggs deposited		Aver. no.of feeding spots /adult / day	Aver. no.of eggs deposited / female / day
		No.	% of the total	No.	% of the total		
1-	Bardy	0	0	0	0	0	0
2-	Bashneen	0	0	0	0	0	0
3-	Lotus	0	0	0	0	0	0
4-	Samaar	0	0	0	0	0	0
5-	Water-hyacinth	2982	100	336	100	7.1	1.6
Total		2982		336			

Table 28 : Number of feeding spots and eggs deposited on different plants when exposed simultaneously to adults of N.bruchi under quarantine conditions (29.9°C and 76.8% R.H.)

Ser. no.	Tested plants	Feeding spots		Eggs deposited		Aver. no.of feeding spots /adult /day	Aver. no.of eggs deposited/ female /day
		No.	% of the total	No.	% of the total		
1-	Bardy	0	0	0	0	0	0
2-	Bashneen	0	0	0	0	0	0
3-	Lotus	0	0	0	0	0	0
4-	Samaar	0	0	0	0	0	0
5-	Water-hyacinth	1218	100	139	100	5.8	1.1
	Total	1218		139			

the feeding spots caused by the adults of N.bruchi was slightly larger than those of N.eichhorniae. The size of each feeding spot caused by N.bruchi adults was 0.08 ± 0.1 cm^2 whereas N.eichhorniae caused feeding spots of 0.05 ± 0.2 cm^2.

B- Paired plants tests :

Both adults of N.eichhorniae and N.brichi fed and oviposited only on waterhyacinth and not on any of the other plants tested, when exposed in combination with waterhyacinth to the adult weevils (Tables 29 & 30). In all cases, the adults survived normally on waterhyacinth neglecting the other tested plants. It was observed that, the highest numbers of feeding spots and eggs deposited on waterhyacinth by the adults of N.eichhorniae was 1192 feeding spots and 123 eggs when paired with Cyperus alopecroides. The highest number of feeding spots caused by N.bruchi counted on waterhyacinth when paired with C.alopecroides was 612 spots. The highest number of eggs deposited by the females of N. bruchi was 78 eggs when paired with C.papyrus.

C- Starvation tests :

During the starvation tests, adults of both N. eichhorniae and N.bruchi fed and oviposited only on

waterhyacinth. Adults exposed to any other plant of the list given in table (26), preffered to die and not to feed or oviposit on any plant other than waterhyacinth. Adults of N.eichhorniae survived a total of 111, 221, 225, 101 and 879 days with an average longevity per adult of 7.4, 14.7, 17.0, 6.7 and 58.6 days on bardy, bashneen, lotus, samaar and waterhyacinth, respectively (Table 31). The total number of feeding spots counted was 5309 with an average number of 6.03 feeding spots per adult per day. The total number of eggs deposited on waterhyacinth was 949 with an average number of 1.8 eggs per female per day. Starved adults of N.eichhorniae survived a maximum of about 2 weeks only when exposed to plants other than waterhyacinth.

The adults of N.bruchi survived a total of 168, 194, 203, 159 and 830 with an average longevity per adult of 11.2, 12.9, 13.5, 10.6 and 55.3 days on bardy, bashneen, lotus, samaar, and waterhyacinth, respectively (Table 32). The total number of feeding spots counted was 4646 with an average of 5.6 spots per adult per day. The total number of eggs deposited on waterhyacinth was 448 eggs with an average number of 0.9 egg per female per day. Starved adults of N.bruchi survived a maximum of about 13 days only when exposed to plants other than

waterhyacinth *Eichhornia crassipes*. No significant differences were found to be occurred between the average longevity of both species when exposed to plants other than waterhyacinth and between starved adults kept without any food. The average longevity of *N. eichhorniae* adults kept without food was 10.2 days per adult. The average longevity of *N. bruchi* kept under the same conditions was 13.4 days per adult (Table 33).

Table 29 : Number of feeding spots and number of eggs deposited on different plants when exposed in combination with waterhyacinth to the adults of *N. eichhorniae* under quarantine conditions. (28.9^{o}C and 80.2% R.H.)

Ser no.	Name of tested plant	Total no. of feeding spots		Total no. of eggs deposited	
		Water-hyacinth	Tested plant	Water-hyacinth	Tested plant
1-	*Cyperus papyrus*	1170	0	117	0
2-	*Nymphaea coerulea*	982	0	109	0
3-	*N. lotus* var. *aegyptia*	1008	0	112	0
4-	*Cyprus alopecroides*	1192	0	123	0

Table 30 : Number of feeding spots and number of eggs deposited on different plants when exposed in-combination with waterhyacinth to the adults of N.bruchi under quarantine conditions. (28.9°C and 80.2% R._.)

Ser. no.	Name of tested plant	Total no. of feeding spots		Total no.of eggs deposited	
		Water-hyacinth	Tested plant	Water-hyacinth	Tested plant
1-	Cyperus papyrus	558	0	78	0
2-	Nymphaea coerulea	562	0	52	0
3-	N.lotus var. aegyptia	479	0	44	0
4-	Cyperus alopecro-ides	612	0	72	0

Table 31 : Feeding,oviposition and longevity of adults of N.eichhorniae confined with individual host plant until death

Ser. no.	Tested plants	Total no of feeding spots	Aver.no.of feeding spots/adult / day	Total no. of eggs deposited	Aver.no of eggs deposi-ted / female / day	Total insect days lived	Aver. longevity of adults (days)
1-	Cyperus papyrus	0	0	0	0	111	7.4
2-	Nymphaea coerulea	0	0	0	0	221	14.7
3-	N.lotus var. aegyptia	0	0	0	.0	255	17.0
4-	Cyperus alopecr-oides	0	0	0	0	101	6.7
5-	Eichhornia crassi-pes	5309	6.03	949	1.8	879	58.6

Table 32 Feeding, oviposition and longevity of adults of N. bruchi confined with individual host plant until death

Ser. no.	Tested plants	Total no. of feeding spots	Aver. no. of feeding spots/adult / day	Total no. of eggs deposited	Aver. no. of eggs deposited / female / day	Total insect days lived	Aver. longevity of adults (days)
1-	Cyperus papyrus	0	0	0	0	168	11.2
2-	Nymphaea coerulea	0	0	0	0	194	12.9
3-	N. lotus var. aegyptia	0	0	0	0	203	13.5
4-	Cyperus alopecroides	0	0	0	0	159	10.6
5-	Eichhornia crassipes	4646	5.6	448	0.9	830	55.3

Table (33): Longevity of starved adults of N.eichhorniae and N.bruchi when kept under quarantine conditions without providing of any food until the death of adults.

Insect species	Total insect days lived	Aver.longevity of adults (days)
Neochetina eichhorniae	153	10.2
N.bruchi	201	13.4

DISCUSSION AND CONCLUSIONS:

The present study is a continuation of the investigations previously started to insure the safety of both N.eichhorniae and N.bruchi for release in nature for the biological control of waterhyacinth without affecting other plants and crops. Results obtained indicated that there would be negligible or no damage outside the family Pontederiaceae, which is to the best of our knowledge, represented in Egypt by water-hyacinth; Eichhornia crassipes only. In the group plants test, which represent the more closely field conditions,

it was found that both species of Neochetina fed and oviposited only on waterhyacinth.

Starvation test provides the most restrictive conditions under which the insect may be existed in the nature. The longevity of adults was comparatively low on all plants other than waterhyacinth, and the life-cycle could be completed only on waterhyacinth. Zwolfer and Harris (1971), mentioned that the question of whether an insect can be develop on a plant species not just feed on it, should be the creterion for judging the safety of an insect before introduction. The question has been answered during the present study and assured the safety of the two species for release. It was found in the present study that, the number of feeding spots per adult per day is considerably low (about 8 spots at maximum). This result provides the nessecity of releasing a teremendous numbers of these weevils to expect better weed control. Furthermore, it needs several years - based on the numbers of released weevils and the size of the infested area - before having good control.

Finally, from all studies conducted in Egypt and several other countries, and from the fact that the life-cycle of both weevils could be completed only by pupation

in cocoons under water, attached to the rootlets of waterhyacinth, provides the safety of introducing and releasing of both N.eichhorniae and N.bruchi in Egypt for the biological control of waterhyacinth.

It has been proved during the present study that, the weevils did not affect rice, papyrus, bashneen, lotus, or samaar which are considered the most economic plants grown in aquatic fauna in Egypt. This result devotes releasing of these weevils in nature in Egypt.

Accordingly, an official decision is taken to release both N.eichhorniae and N.bruchi in nature. In May, 1982 adults of both species have been released in an artificial lake in Al-Orman Garden at Giza, Giza governorate.

1- Survey of Myriophyllum spp. in Egypt: Family : Haloragaceae

Eurasian Water-Milfoil (Myriophyllum spicatum L.) Fig. 15 is one of the most important aquatic weeds in USA and Europe. It causes a serious problems in the rivers, irrigation canals, drianages, lakes and dames. Fortunately, this weed does not cause any problem in Egypt untill now. El-Sayed, J.K.*, under Secrtary of State, Sector of Channel Maintenance and Aquatic Weed Control, Ministry of Irrigation, reported that the weed is very rare in Egypt. He added that it occurs in very few numbers in Quantara west near Ismaelia governorate and in Karoun Lake (Fayoum governorate). The weed grow in very shallow water (15 cm.) in fresh and saline water, on muck to hardpacked sand.

Several surveying trips were conducted during the project period to determine the occurrence of Myriophylum spicatum in Egypt. In each trip several sites in each locality were examined. All aquatic weeds in each site were collected, examined in sita and transeffered in plastic bags to the laboratory for identification. Identification determined reffering to "The Students Flora of Egypt by

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* Unpublished report entitiled" Plants and weeds of fresh water and plants associated with irrigation and drainage canals in Egypt 19[illegible], ([illegible]).

Fig. 15: Myriophyllum spicatum L.

Vivi Tacholm 1956 and the Cataloug of the survey of the scientific names of aquatic plants related to irrigation and drainage system in Egypt by J.A. Abdel-Sayed Ministry of Irrigation Cairo, Egypt 1979. Informations obtained are given in tables (34 & 35).

Results given in tables (34 & 35) seems to indicate the following :-

1- During the period of this work, 24 collecting trips have been conducted to almost all governorates of lower Egypt Mediterranean Coast and Fayoum to survey submerged aquatic weeds existed in the area especially the Eurasian Water-Milfoil (Myriophyllum spicatum L.)

2- The 147 sites examined during the reporting period, indicated the absence of Myriophyllum spp. from the surveyed governorates during the period September 1980 to June 1981.

3- Identification of the collected submerged aquatic weeds proved the absence of Myriophyllum spp. and the main species collected are :
Potamogeton crispis L., Potamogeton pectinatus L., Najas armata Lindb., and Ceratophyllum demersum L.

Table 4: Survey of the Eurasian Water-Milfoil (*Myriophyllum spicatum* L.) In Egypt (September 1980-June 1981)

[illegible]	Dates	Locality	Governorate	No. of examined sites	Occurrence of the [illegible]
	12.9.80	Quantara West	Sinai	8	-
	20.9.80	Fayoum	Fayoum	4	-
	3.10.80	Mansoura	Dakahlia	7	-
	20.10.80	Ismaelia	Ismaelia	9	-
	1.11.80	Baher-El-Baker	Port Said	3	-
	3.11.80	Ismaelia	Ismaelia	5	-
	14.11.80	Tanta	Gharbia	7	-
	3.12.80	Mariout Lake	Alexandria	4	-
	8.12.80	Fayoum	Fayoum	4	-
	12.1.81	Fayoum	Fayoum	6	-
	3.2.81	Quantara	Sinai	4	-
	5.2.81	Ismaelia	Ismaelia	9	-
	21.2.81	Demiat	Demiat	10	-
	3.3.81	Fayoum	Fayoum	6	-
	13.3.81	Port Said	Port Said	8	-
	15.3.81	Ismaelia	Ismaelia	[illegible]	-
	8.4.81	Zakazik	Sharkia	6	-
	24.4.81	Benha	Qualuobia	5	-

Table 34: (Con.)

Ser. No.	Dates	Locality	Governorate	No.of examined sites	Occurre-nce of the weed
19	30.4.81	Ashmoon	Menoufia	3	-
20	11.5.81	Fayoum	Fayoum	4	-
21	25.5.81	Damanhour	Behiera	9	-
22	3.6.81	Mariout	Alexandria	8	-
23	15.6.81	Ismaelia	Ismaelia	5	-
24	18.6.81	Port Said	Port Said	4	-

Table 55 List of Submerged Aquatic Weeds Found During The Period September 1980 -June 1981 Survey

Ser. No.	Common Name	Scientific Name	Family	Governorates
1	Curly leaf Pondweed	_Potamogeton crispus_ L.	Potamogeton-aceae	Sinai, Fayoum, Dakahlia Ismaelia, Port Said, Gharbia, Demiat, Sharkia, Menoufia, Behiera, Qualubia
2	Sago Pondweed	_P.pectinatus_ L.	"	Alexandria, Port Said, Ismaelia, Demiat
3	Marine Naiad	_Najas armata_ Lindb	Najadaceae	Alexandria, Demiat, Port Said, Fayoum
4	Coontail	_Ceratophyllum demersum_ L.	Ceratophy-llaceae	Sharkia, Behiera

During a following period, several surveying trips were conducted to different sites in Egypt particularly to the sites where several authors had previously recorded the weed Myriophllum spicatum to determine its occurrence in the country. Furthermore, during the visit of Dr. Balcinunas to Egypt, certain field trips were conducted, and within these trips, searching for Myriophyllum was considered. The same procedure described was followed. Results and informations obtained from this survey are given in Table (36).

Results given in Table (36) indicated the following :-

1- During the period of this work, 23 collecting trips were conducted to several localities in the country, searching on the submerged aquatic weed; Myriophyllum spicatum L. The survey covered almost all areas where the weed expected to be found all the year around.

2- During the collecting trips conducted, 120 different sites were examined. Results obtained indicated the absence of the weed Myriophyllum from all of the examined sites.

It is believed that, although this weed is very rare in Egypt, more attention should be given for conducting several surveying trips to more other localities, in different seasons, before final decision could be made.

Table [illegible]: Survey of the Eurasian Water-Milfoil (*Myriophyllum spicatum*) in Egypt

(July 1981 - June 1982)

Ser. no.	Date	Locality	Governorate	No. of examined sites	Occurrence of the weed
1-	5.7.81	Fayoum	Fayoum	5	-
2-	20.7	Ismaaelia	Ismaelia	8	-
3-	22.7	Port Said	Port Said	4	-
4-	8.8	Mariout	Alexandria	5	-
5-	10.8	Edeco	Beheira	6	-
6-	26.8.81	Koom-Osheem	Fayoum	3	-
7-	15.9	Quantara West	Sinai	6	-
8-	17.9	Baher-El-Baker	Port Said	4	-
9-	12.10	El-Sabahia	Alexandria	5	-
10-	13.10	Mariout	Alex.	4	-
11-	30.10	Mansoura	Dakahlia	5	-
12-	30.10	Demiat	Demiat	3	-
13-	15.11	Fayoum	Fayoum	7	-
14-	13.12	Beni-Suef	Beni-Suef	5	-
15-	20.1.82	Ashmoon	Menoufia	6	-
16-	5.2	Ismaelia	Ismaelia	4	-
17-	7.2	Port Said	Port Said	4	-
18-	23.2	Zakazik	Sharkia	7	-
19-	24.2	Benha	Qualubia	5	-
20-	12.3	Quantara	Sinai	6	-
21-	14.3	Port Said	Port Said	5	-
22-	12.3	Fayoum	Fayoum	8	-
23-	3.5	Fayoum	Fayoum	5	-

SHIPMENTS TO <u>NEOCHETINA</u> SPP. RECIEVED IN EGYPT DURING THE PROJECT

During the period April 8-28, 1979 the principal investigator in cooperation with Dr. Ted Center the cooperating scientist of the project and his staff collected 820 individuals of both *N.eichhorniae* and *N.bruchi*. These insects were arrived to Egypt and studied under quarantine conditions. Two shipments of the adult weevils were recieved in Egypt to complete the study and to start field release. The first one recieved in September 1979 hand delivered by Dr. Ted Pfrimmer who was visiting Egypt to review some other projects. Unfortunately, it took more than 10 days in the way before opening of the backage under quarantine conditions in Egypt. This delay caused death of all the recieved insects. In July 5, 1980; 32 adults of *N.bruchi* all of them arrived to Egypt in good condition and 343 adults of *N.eichhorniae* (221 of them only were alive), hand delivered by Dr. M.E. Getz. Weevils were tested to complete host specificily tests under quarantine conditions.

During a next period, two consignments of *Neochetina* and one of *Sameodes* have been recieved. Information of these insects are given in table (37).

TABLE 57 : INSECTS INTRODUCED TO EGYPT TO BE STUDIED FOR CONTROL OF WATERHYACINTH DURING THE PERIOD July 1, 1980 - June 30, 1981

Ser. No.	Receiving Date	Collecting Localities	Species of insects	Insect's stage	No.of received insects		Condition
					Alive	Dead	
1	July 5, 1980	Fort Laud-erdale, Florida	*Neoche-tina bruchi*	Adults	32	0	Good
2	July 5, 1980	"	*N.eichhor-niae*	"	221	122	Good
3	August 5,1980	Brisbane, Australia	*N.eichhor-niae*	"	310	0	Good
4	April 24,1981	Fort Lauder-dale, Florida	*Sameodes albiguttalis*	"	20	32	Good

TABLE 37 (cont.)

Ser. No.	Receiving Date	Collecting Localities	Species of insects	Insect's stage	No.of received insects		Condition
					Alive	Dead	
5	April 24,1981	Fort Lauderdale, Florida	*S.albiguttalis*	Pupae	68	12	V.Good
6	April 24,1981	Fort Lauderdale, Florida	*S.albiguttalis*	Newely hatched larvae	Few	Many	Bad
7	April 24,1981	Fort Lauderdale, Florida	*S.albiguttalis*	Deposited eggs	Many	V.few	V.Good

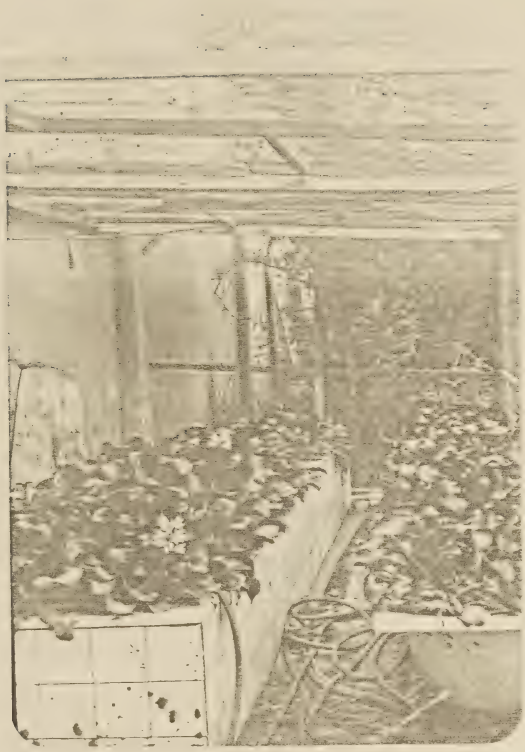

Fig. (16): Bathtubs used for growing of waterhyacinth under wire screen cage in the laboratory.

RELEASE AND ESTABLISHMENT OF NEOCHETINA SPP. IN NATURE IN EGYPT.

1) Release of *Neochetina eichhorniae* in Egypt.

In July 1980, two different sites have been choosen for the insect release. The first location was Embaba, near Cairo and the second was Mariout lake, Alexandria. Sixty five insects were released in the first site and 50 adults in the second site. The first releasing site has been examined in October and December 1980 with the result of no feeding spots were observed. In March 1981 feeding spots have been observed on water-hyacinth leaves. It has to be mentioned that the numbers of adults released in this particular site were 65 only. Unfortunately, the second releasing site was treated officially because of the heavy infestation of waterhyacinth. In August 1980, the Principal Investigator brought about 310 adults of *N.eichhorniae* collected from Brisbane Australia. Out of which, 25 adults have been released on waterhyacinth in nature at the Parasite Laboratory, Giza.

2- Based on the results obtained during the project period which indicated the safety of both *Neochetina eichhorniae* and *N.bruchi* to be released in nature for control of waterhyacinth, the Ministry of Agriculture

approved the release in an artificial lake infested with waterhyacinth in Al-Orman Garden, Giza.

In April 1982, Dr. J.K.Balcinuas, who was in Egypt to review the project activities; kindely submitted certain numbers of both Neochetina spp. collected from Fourt Lauderdale, Florida. In May 13, 1982; only 10 adults of N.bruchi and 15 of N.eichhorniae were released in an artificial lake of about 130 m^2 in Al-Orman Garden by placing the adults within waterhyacinth leaves.

Six waterhyacinth plants harboured 15 adults of N.eichhorniae and 4 plants harboured 10 adults of N.bruchi were placed in two chosen sites in the lake (Fig. 17). It has been meant to introduce few numbers of the weevils to make it easier and definite for evaluation. In May 16, 1982 the plants were examined for feeding spots. Certain numbers of feeding spots were observed on the leaves of about 10-12 new waterhyacinth plants, other than those previously placed in the lake. By August 1982, several waterhyacinth plants were observed in the lake with many feeding spots on the leaves and petioles. Evaluation studies and follow up for establishment and the rate of spreading of both N.eichhorniae and N.bruchi would be conducted. Preliminary successful results have been obtained concerning this aspect.

Fig. 17 : Releasing site of <u>Neochetina</u> spp. in Al-Orman lake,Giza,Egypt

The few number of weevils released would make it easier for evaluation. Releasing sites were examined periodically during the first 6 months of release for feeding spots. Preliminary results indicated the establishment of the released weevils in nature. During the reporting period the releasing site was examined almost every two weeks. Number of plants per m^2 was determined in five locations. Five plants from each sample were examined for number of leaves/plant, number of newly feeding spots, number of adults/plant, root length, petiole length and leaf area were determined. Results obtained are summarized in Table (38).

Data summarized in table (38) indicated that during the reporting period 18 examinations were conducted in the releasing site, once every two weeks during the growing season of waterhyacinth and monthly during winter. Few days after releasing of the insects, it was observed that certain numbers of feeding spots were occured on waterhyacinth leaves other than those previously placed with the weevils in the lake.

The number of plants per m^2 ranged between an average of 52.5 and 124.7 plants. It is to be mentioned that in general, the number of plants per m^2 increases during the growing season since new vegetations grow up and many small plants occurred.

Table 38 : Evaluation studies of Neochetina eichhorniae and N.bruchi released in nature for control of waterhyacinth in Egypt.

Ser. No.	Date	Aver.No. of plants/ m2	Ave.No. of leaves/ plant	Total no. of insects found /25 plants		Total no. of feeding spots	Measurements of plants		
				N.eichhorniae	N.bruchi		Ave.root length cm	Ave. petiole length cm.	Ave. leaf area cm2.
1	July 25,1982	104.2	8.6	2	1	225	70.2	51.1	82.5
2	August 10,	108.7	8.2	2	2	329	64.9	48.3	79.6
3	August 24	88.3	7.9	4	4	562	71.9	54.5	130.6
4	September 18	92.4	7.9	7	3	549	68.3	46.8	87.2
5	October 3	104.1	6.5	7	8	782	72.8	47.2	112.5
6	October 25,	80.0	7.2	6	6	721	69.3	41.5	87.0
7	November 20,	72.0	7.5	5	7	634	70.1	39.8	60.5
8	December 18,	52.5	6.2	3	2	482	59.8	39.6	72
9	Jan. 15, 1983	56.1	4.8	2	0	263	49.3	40.3	159.5
10	February 5,	60.1	4.9	5	4	689	51.2	44.7	96.2
11	February 26,	66.0	5.8	4	3	780	48.7	43.3	80.6
12	March 13	84.8	6.9	4	4	930	54.9	39.8	82.5
13	March 29	80.6	6.8	6	3	1340	61.2	46.3	110.7
14	April 15	109.5	7.6	7	5	1692	68.7	43.7	168.8
15	May 2	124.7	8.4	8	6	2120	63.6	52.5	92.9
16	May 19	119.3	8.6	8	7	2436	59.4	57.7	110.7
17	June 7	120.2	8.7	9	4	2318	67.9	59.3	98.3
18	June 25	118.3	8.6	7	6	2523	70.1	68.4	80.9

During this period, 3 consignments of different species of benificial insects have been recieved in Egypt for completing of the studies required under quarantine condition, semi-natural field release and to start biological studies and host specificity tests of Sameodes albiguttalis under quarantine conditions. The first consignment of Neochetina spp was arrived in July 1980 with Dr. E. Getz who was in official visit to Egypt not related to PL 480 projects. The second consignment of N.eichhorniae was collected from Brisbane, Australia and arrived accompanied by the principal Investigator who was attending the V International Symposium on the Biological control of Weeds. The third consignment of S.albiguttalis was the first shipment of this species arrived with our colleagues in the Foreign Relation Department whom they were in official visit to USDA. Some biological studies and host specificity tests of S.albiguttalis were conducted.

In April 14, 1982; 69 adults of Neochetina eichhornniae and 22 adults of N.bruchi were recieved in Egypt accompanied by Dr. J.K. Balcinuas, who was in an official visit to review the project actvities. The insects were collected from the field in Fort Lauderdale, Florida and introduced to our quarantine facilities to be examined for any disease infestations. Eggs obtained

from both species were inserted in waterhyacinth plants and transferred to bathtubs in the open in the Parasite Laboratory and also to an artificial lake infested with waterhyacinth in Al-Orman Gardan. Details about the release of both *Neochetina* spp. is reported under the following point.

Dr. Balcinuas delivered also 36 pupae and adults of the lepidopterous moth; *Sameodes albiguttalis*. Few adults were emerged under quarantine conditions. Unfortunately, all of them were males. Both the Principal Investigator and the Co-operating Scientist prefered to concentrate efforts on the release and establishment of both *Neochetina* spp. followed by evaluation studies of their role of control and their natural spreading in new infested areas of waterhyacinth. Introduction of *S. albiguttalis* and possibly some other organisms to Egypt further studies was acceptable.

RELEASE OF *N.EICHHORNIAE* UNDER SEMI-NATURAL CONDITIONS IN EGYPT.

In August 1980, 25 adults only of *N.eichhorniae* out of 310 adults introduced to Egypt from Brisbane, Australia have been released on waterhyacinth growing in bathtubs under screen wooden green house in the Parasite Laboratory at Giza (Fig. 16).

In November 1980, the first generation has been emmerged. In March first, 1981 a new generation was obtained. Two more overlaping generations have been seen in late April and June 1981.

It has to be mentioned that, it seems to be difficult to find a releasing site in nature in Egypt since all waterhyacinth is obliged to be treated by the government. Recently, in cooperation and arrangements with Ministry of irrigation a possibility of saving an area infested with waterhyacinth without chemical treatment was negotiated.

In the released site, the average number of leaves per plant ranged between 4.8 and 8.7 leaves per plant. The maximum number of adults of N.*eichhorniae* found per 25 plants was 9 adults during June 1983, while a maximum of 8 adults of N.*brichi* was counted during October 1982. A maximum of 3 adults per plant were counted. Few adults were counted during December 1982 and January 1983 since the weevils entered a hibernation stage and no insects produced. It has to be mentioned that the number of N.*eichhorniae* found slightly increase the number of N.*bruchi*. This result was acceptable since 15 adults of N.*eichhorniae* to 10 of N.*bruchi* were released.

The total number of feeding spots counted in July 1982 after about 2 months of release, were 225 feeding spots per 25 plants caused by 25 released adults of both species. The maximum number of feeding spots counted were 2523 per 25 plants during June 1983. Based on the size of each feeding spots which ranged between 4 mm^2 to 8 mm^2, the last total number of feeding spots represents a total area of about 20.2 $m^2$of leaves exposed surface.

From our side of view and studies conducted on those two weevils, and from field observations, it will take so much period and needs a teremendous number of insects to obtain possitive results in controlling waterhyacinth.

On the other hand, the main role of these weevils appear from their behaviour as leaf feeders. It was indicated that waterhyacinth causes a serious problem by water loss through evapo-transpiration from its wide leaves. The rate of transpiration from waterhyacinth infested area is about 3.2-3.7 times compared with that of water free surface. Accordingly, reduction in the leaf surface by insect feeding considered successful control. It is to be indicated that insects released on May, 1982 in only 2 sites in an artificial lake, have been established and covered the whole lake. Feeding spots could be easily seen everywhere on waterhyacinth in the lake.

5- PRELIMINARY HOST SPECIFICITY TESTS OF THE PYRALID MOTH; SAMEODES ALBIGUTTALIS (WARREN)

In April 24, 1981 a shipment consists of different stages of the pyralid moth; Sameodes albiguttalis were recieved under quarantine conditions in Egypt. This species was collected from the nature in Fort Lauderdale Floride and introduced to Egypt for host specificity tests. During the period of this report, preliminary host preference tests were conducted with certain plants and crops of economic importance. The list of plants tested is given in Table (39).

METHODS :

Eggs and larvae of Sameodes albiguttalis were used in this test. Insects were collected from released colonies in Fort Lauderdale Florida and hand carried by Dr. J.K.Balciunas to Egypt. A total of 12 plants and crops, including waterhyacinth were tested. As we are considering the present study on Sameodes a preliminary study, only larval feeding test was conducted. Three experiments were conducted under quarantine conditions of 28.3^{o}C and 79.2% R.H.

Test I :

In the first test, deposited eggs were transfered to certain punctures made in the stems, petioles, and

Table (39): List of plants tested for the host specificity of Sameodes albiguttalis under quarantine conditions in Egypt

Ser. no.	Tested Plants		Family
	Common name	Scientific name	
1-	Banana	Musa paradisiaca	Musaceae
2-	Boos	Phragmites communis Trin	Gramineae
3-	Clover	Trifolium alixandrinum L.	Leguminosae
4-	Cotton	Gossypium barbadense L.	Malvaceae
5-	Indian shot	Canna indica L.	Cannaceae
6-	Maize	Zea mays L.	Gramineae
7-	Onion	Allium cepa L.	Liliaceae
8-	Rice	Oryza sativa L.	Gramineae
9-	Sorghum	Sorghum vulgare Pers.	"" "" ""
10-	Sugar-cane	Saccahrum officinarum L.	"" "" ""
11-	Waterhyacinth	Eichhornia crassipes (Mart.)Solms	Pontederiaceae
12-	Wheat	Triticum vulgare Vill.	Gramineae

Table (40): Development of larvae of *Sameodes albiguttalis* on different plants under quarantine conditions in Egypt

($28.3^{o}C$ and 79.2%R.H.)

Ser. no.	Test plant	No.of larvae developed to various stages			Total no.of eggs and larvae tested	Total no.of pupae or adults recorded
		Test I	Test II	Test III		
1-	Banana	0	0	0	420	0
2-	Boos	0	0	0	348	0
3-	Clover	0	0	0	350	0
4-	Cotton	0	0	0	400	0
5-	Indian shot	0	0	0	350	0
6-	Maize	0	0	0	348	0
7-	Onion	0	0	0	370	0
8-	Rice	0	0	0	410	0
9-	Soghum	0	0	0	390	0
10-	Sugar-cane	0	0	0	350	0
11-	Waterhyacinth	12a	2b,8c	18c,1p	348	1
12-	Wheat	0	0	0	350	0

a 3rd.instar larva; b 4th instar larva;c full grown larva
p pupa

leaves, based on the species of tested plants. Three replicates were conducted. Five eggs were placed in each plant. Plants tested were grown in the laboratory or brought from the field. A whole plant or only leaves or cut pieces of stems were used. Plants with inserted eggs, were kept in wooden glass door cage of 47 cm x 47 cm x 66 cm in the quarantine room. After one week, all plants were dissected and number of hatching eggs and living larvae were recorded. Larvae were transferred to a fresh host plant for further development.

Test II :

In this test 3-5 first instar larvae not more than 2 days old, were transferred to each of the plants listed in table (39) and placed in artificial punctures made in each plant. Three replicates were conducted for each plant. After 2-3 weeks, all plants were dissected and the number of larvae and the stages were recorded. Living larvae were transferred to fresh plant kept and observed for further development.

Test III :

This test was the same as test II except using of the fourth instar larvae of *S.albiguttalis*. Larvae were reared to this stage feeding on waterhyacinth. After 24 hours starvation, five fourth instar larvae were placed on each plant. Small longtudinal cut was

made in the plants to assist enterance of the larvae into the plants. Larvae were observed daily. After 2 weeks, plants were dissected and number of larvae, pupae or emerged adults were recorded.

RESULTS AND DISCUSSION :

Results obtained from the host specificity tests of Sameodes albiguttalis are shown in Table (40). These results indicated that, S.albiguttalis was very specific to feed and develop on the target weed; water-hyacinth and not on any of the other plants tested. It is to be indicated that, in all host specificity tests, eggs were hatched normally, with a rate of about 80.8% of the total number of eggs tested. All the hatched larvae died on different plants tested within 48 hours except those reared on waterhyacinth, where 12 larvae developed to the 3rd. instar in the first test, 2 larvae reached the 4th instar and 8 developed to the full grown larvae in test II, whereas 18 larvae developed to the full grown, and one formed pupa in the 3rd test. Unfortunatly, no adults emerged during these tests and this seemed to be due to the lack in our rearing technique of waterhyacinth under quarantine conditions at that time. It is to be indicated that, from observations obtained during these tests, no symptoms of feeding

were occurred on any of the plants tested other than waterhyacinth. As it was mentioned before, these are considered as preliminary results and first approach for studying of *S.albiguttalis* as other candidate for the biological control of waterhyacinth in Egypt. So, advanced studies would be conducted under quarantine conditions and in the field before final decision could be made.

As it has been suggested by the co-operating scientist, studies on the species *Sameodes albiguttalis* would be conducted after completing our studies on *Neochetina* spp. and establishment of the released colonies.

7- VISIT OF DR. J.K.BALCIUNAS TO EGYPT

During the period 13-20 April, 1982 Dr. J.K. Balciunas, Research Entomologist, Aquatic Plant Management Laboratory, Fort Lauderdale, Floride conducted an official visit to Egypt to review the project activities for Dr. Ted Center the co-operating scientist of the project.

Local Trip Details :

Wed 14 April, 1982 :	Arrive Cairo, met at the Air Port by the Principal Investigator.
Thurs 15	Visit U.S.A. Embassy, travel to Alexandria accompanied by the Principal Investigator and Co-investigator.
Fri 16	Field trip to survey aquatic weeds in Lake Edeco North East of Alex.
Sat 17	Inspecting waterhyacinth in Mariout Lake south of Alex. Return to Cairo.
Sun 18	Discussion with the Principal Inv. and other staff members at the Parasite Lab., Giza.

Tues 20 Apr. : Visit to U.S.A. Embassy
Non time, Dr. Balciunas presented a furitful seminar at the Plant Protection Institute, Dokki, Egypt.

Wed 21 Apr. Leave Cairo, 2 am.

Dr. Balciunas kindely hand carried and delivered to Egypt the weevils of Neochetia eichhorniae and N.bruchi and the pyralid moth; Sameodes albiguttalis which were collected from Fort Lauderdale, Floride upon our request. These insects were examined in the quarantine and setted up. Informations about these insects are given in this report.

During the stay of Dr. Balciunas, 2 days surveying trips were conducted in Edeco and Mariout Lakes North and South of Alexandria.

After a visit to the Giza Zoo and Al-Orman Garden, two releasing sites were chosen of Neochetina spp. Few days following the visit, the weevils have been released in an artificial lake in Al-Orman Garden. Information about this release is given in this report.

Two main recommendations were suggested by Dr.Balciunas

1- Releasing and establishing Neochetina in the field.
2- Develop lighting facilities for growth of water-hyacinth in the quarantine. Both recommendations have been accepted and already implemented.

OTHER ACTIVITIES

During the project period, the principal investigator attended the V International Symposium on the Biological Control of Weeds held in Brisbane, Australia from 22 to 29 July 1980. Following the Symposium, the principal investigator spent about one week in cooperation with CSIRO DIvision of Entomology, Long Pocket Laboratories Indooroopilly to collect *N.eichhorniae* to be hand carried to Egypt. A total of 310 adults were collected and arrived to Egypt in a good condition.

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